JAN 16 1918
UNIV. OF MICH. LIBRARY

ISSUED BI-MONTHLY. VOL. XLVII., No. 1

ARCHIVES

OF

OPHTHALMOLOGY

FOUNDED IN 1869 BY

DR. HERMAN KNAPP

EDITED IN ENGLISH AND GERMAN

BY

DR. ARNOLD KNAPP
OF NEW YORK
AND
DR. C. HESS
OF MUNICH
AND
DR. W. A. HOLDEN
OF NEW YORK

JANUARY

NEW YORK
G. P. PUTNAM'S SONS, 2, 4, & 6 WEST 45TH STREET
AND NEW ROCHELLE, N. Y.
LONDON: 24 BEDFORD STREET, STRAND
WIESBADEN: J. F. BERGMANN'S Verlag
PARIS: J. B. BAILLIÈRE, 19 Rue Hautefeuille
1918
Entered at the Post-Office, New Rochelle, N. Y., as Second-Class Mail Matter

NOTICE TO CONTRIBUTORS.

The editors and publishers of the ARCHIVES beg to offer some suggestions to authors who propose to favor them with the publication of their contributions.

1. Authors will receive gratuitously twenty-five reprints of their articles. If a greater number is desired,—**notice of which should be given at the head of the manuscript, or at the latest on the first proof,**—only the additional cost of press-work and paper will be charged to the author. The **number so ordered should be inclusive of the gratuitous copies.**

2. In preparing manuscript for the compositor it is requested that the following rules be adhered to:

a. Write on one side of the paper. Type-written MS. is preferred.

b. Write without breaks, *i. e.*, do not begin each sentence on a new line. When you want to begin a new line or paragraph at a given word, place before it in your MS. the sign ¶.

c. Draw a line along the margin of such paragraphs as should be printed in smaller type—for instance, all that is clinical history in reports of cases, etc.

d. Words to be printed in *italics* should be underscored once, in SMALL CAPITALS twice, in LARGE CAPITALS three times; **antique** type should be so marked.

e. Let the title of your paper indicate its contents. If it is a general title, for instance, Clinical Contributions, mention the subject of each special communication,—for instance: CASE I. Sarcoma of Iris; CASE II. Exostosis of Frontal Sinus, etc. These special titles will appear in the table of contents of each number and each volume, under the heading of the general title, so that they will not be overlooked.

f. Illustrations should be carefully drawn on separate sheets.

3. Authors receive proofs for revision, which they should correct and return without delay. We beg, however, to remind our contributors that changes in the copy are equivalent to resetting, causing so much additional expense. We therefore request them to make, if possible, no alterations at all in their MSS., or, at least, to limit them to what is of essential importance.

When sending manuscripts for the ARCHIVES OF OPHTHALMOLOGY, please address the editor, Dr. ARNOLD KNAPP, 10 East 54th St., New York City.

EDITORIAL NOTICE.

The Archives of Ophthalmology is a bi-monthly journal, published in annual volumes of about six hundred pages each, extensively illustrated with cuts in the text, half-tone text plates, and lithographic plates, many in colors.

About three quarters of the space is devoted to original papers, and the remaining quarter to a systematic report on the progress of ophthalmology, and to reports of societies, book reviews, and miscellaneous notes, all of it original.

The papers and reports are original, and only accepted with the understanding that they are to be published in this journal exclusively. The original papers in the English edition appear in the German (*Archiv für Augenheilkunde*) either in full or in more or less abridged translations, and *vice versa*. Any subscriber who wishes to refer to the original text of a translated or abridged paper may, by applying to the editors, obtain a reprint which he is expected to return after perusal. The subscription price of the ARCHIVES OF OPHTHALMOLOGY is $5.00 per year payable in advance. The price per number is $1.00.

The ARCHIVES is sent postage free in the United States, Canada, Mexico, Cuba, and our insular possessions.

CONTENTS OF VOLUME XLVII., NUMBER 1.

PAGE

1. **Ocular Changes in Acne Rosacea. One Case of Rosacea Ocularis Complicated with Fascicular Keratitis.** By Dr. M. URIBE-TRONCOSO, New York. (With three illustrations on Text-Plate I.) 1

2. **The Production of Cataract.** By Dr. W. E. BURGE, Urbana, Ill. (With seven figures on Text-Plates II.–III.) . . . 12

3. **Salvarsan and Other Remedies in Ophthalmic Practice.** By FREELAND FERGUS, Glasgow 29

4. **Five Years' Experience with Iridotasis.** By Dr. DAVID HARROWER, Worcester, Mass. (With two figures in the text). . 37

5. **Late Infection with Enucleation Following an Operation of Iridotasis for Chronic Glaucoma.** By Dr. DUNBAR ROY, Atlanta, Ga. (With one illustration on Text-Plate IV.) . . 42

6. **Tension in Normal Eyes before and after Tonsillectomy.** By ANDY M. CARR, A.B., M.D., Chicago 46

7. **Asteroid Hyalitis.** By Dr. T. B. HOLLOWAY, Philadelphia . 50

8. **Leukæmic Manifestations in the Eye: A Clinical and Pathological Report.** By Dr. MARTIN COHEN. (With two figures on Text-Plate V.) 61

9. **Penetrating Injury Limited to the Eyeball Followed by Acute Tetanus.** By Dr. ROBERT SATTLER, Cincinnati, Ohio . . 64

10. **A Case of Unilateral Proptosis. Exploratory Operation. Tentative Diagnosis of an Ethmoidal Osteoma.** By Dr. ROBERT SATTLER, Cincinnati, Ohio 68

11. **Sarcoma of the Choroid with Secondary Changes.** By Dr. EDWARD JACKSON, and Dr. WILLIAM C. FINNOFF, Denver, Colo. 72

12. **Report of a Tumor of the Frontal Lobe of the Brain with Ocular Symptoms. Autopsy.** By Dr. ARNOLD KNAPP, New York. (With two figures in the text and three illustrations on Text-Plates VI.–VII.) 83

PAGE

13. **Report on the Progress of Ophthalmology. German Report for the Second Quarter of 1916** (*Concluded*). By H. KOELLNER, Berlin; W. KRAUSS, Marburg; R. KÜMMELL, Erlangen; W. LOEHLEIN, Greifswald; H. MEYER, Brandenburg; W. NICOLAI, Berlin; H. PAGENSTECHER, Strassburg; K. WESSELY, Wurzburg; and M. WOLFRUM, Leipsic; with the Assistance of Drs. ALLING, New Haven; CALDERARO, Rome; CAUSÉ, Mayence; CURRAN, Kansas City; DANIS, Brussels; GILBERT, Munich; GROENHOLM, Helsingfors; v. POPPEN, Petrograd; TREUTLER, Dresden; and VISSER, Amsterdam. Edited by MATTHIAS LANCKTON FOSTER, M.D., F.A.C.S., New Rochelle, N. Y. 88

XI.—Lacrimal passages, 88; XII.—Orbits, exophthalmos, accessory sinuses, 89; XIII.—Conjunctiva, 92; XIV.—Cornea and sclera, 98; XV.—Iris, pupils, 102; XVI.—Sympathetic ophthalmia, 103; XVII.—Lens, 104; XVIII.—Glaucoma, 105; XIX.—Retina and optic nerve, 109; XX.—Accidents, wounds, foreign bodies, parasites, 112.

ILLUSTRATING DR. URIBE-TRONCOSO'S ARTICLE ON "OCULAR CHANGES IN ACNE ROSACEA. ONE CASE OF ROSACEA OCULARIS COMPLICATED WITH FASCICULAR KERATITIS."

FIG. 1.

FIG. 2.

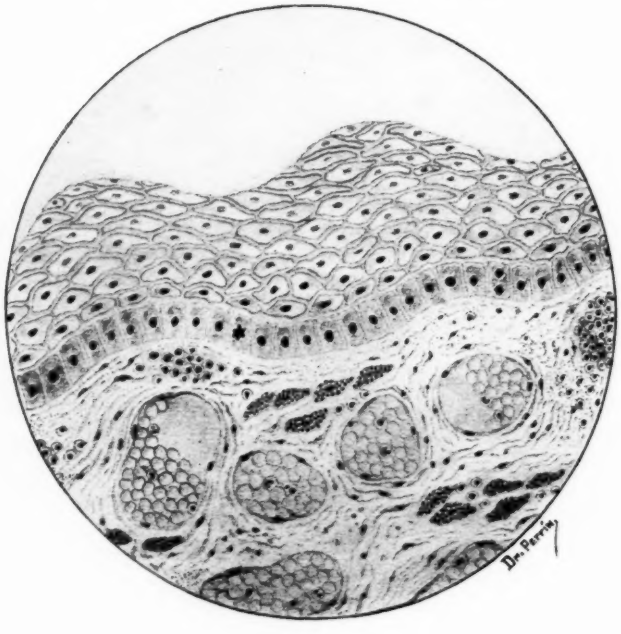


FIG. 3.

ARCHIVES OF OPHTHALMOLOGY.

OCULAR CHANGES IN ACNE ROSACEA. ONE CASE OF ROSACEA OCULARIS COMPLICATED WITH FASCICULAR KERATITIS.

BY DR. M. URIBE-TRONCOSO.

ASSISTANT PROFESSOR OF OPHTHALMOLOGY, NEW YORK POST-GRADUATE MEDICAL SCHOOL AND HOSPITAL, NEW YORK.

(With three illustrations on Text-Plate I.)

THE ocular localizations of acne rosacea have been studied with great interest in late years. Although its existence was pointed out by Arlt in 1864 and afterwards described by Fuchs and Vossius, the characteristic signs of the disease were only definitely stated by Capauner (1), Kuntz (2), Wicherckiewicz (3), Schirmer (4), Blancke (5), Sydney Stephenson (6), and later by Erdmann (7), Holloway (8), Caralt (9), and others (10).

Erdmann proposed the names of Rosacea Keratitis and Rosacea Conjunctivitis, which have been adopted, and accordingly this disease is so described in modern text-books and monographs, but these names in our opinion are limited and must be substituted by the more comprehensive term of Rosacea Ocularis.

Although numerous cases of this disease have been published in recent years, the clinical aspects of the varied manifestations of rosacea of the eye have not yet been described, nor its etiology and pathogenesis entirely proved. All authors have mentioned the great resemblance of the ocular rosacea to

phlyctenular keratitis, but until recently no reference of its association with fascicular keratitis has been recorded. For this reason, as I was fortunate enough to observe a case of this nature, I think it worth while to describe and discuss it thoroughly in order to ascertain the character of the disease.

The history of the case is as follows:

A. B., 44 years old, was first seen by me on September 9, 1914. He is a strong and vigorous farmer, who began to notice some reddening of the right eye about a year previously, produced according to his own statement by the introduction of a foreign body on the conjunctiva.

He gave a history of gonorrhœa and chancroid at the age of twenty-one and chronic nasal catarrh. No evidences of syphilis were found. He was a heavy drinker of wines and liquors until lately, when he stopped alcohol.

Since youth he had on both cheeks red plaques of rosacea with which he was very pleased because these gave him an appearance of health, but one year ago the red areas became irritated and an attack of acne occurred extending gradually afterwards to the forehead.

Some weeks after the beginning of the acne the right eye was involved in the inflammation, which, according to the patient's statement, was confined to the inner portion of the conjunctiva. In May, 1914, after prolonged exposure to the night air the skin of the face became more inflamed and the injection of the conjunctiva extended to the cornea where a white spot appeared, accompanied by photophobia and lacrymation. In July of the same year another white spot appeared in the outer part of the cornea, with increased irritation and lacrymation. As his condition became worse he was compelled to come to the city for consultation.

His condition when I saw him was as follows: On both cheeks there existed extensive and highly congested areas of acne rosacea, covered with a great number of small pustules of acne and suppurative folliculitis, much more confluent near the lower eyelid. The naso-malar furrows were smeared with the greasy secretion characteristic of seborrhea.

On the right eye the skin and margins of the lids were normal, but a marked blepharospasm was present and a great quantity of tear secretion flushed out when the lids were forcibly separated. The conjunctiva was strongly injected. Upon the inner portion of the cornea could be observed, advancing almost to its middle third, one stripe of dense gray-white infiltration ending in a broader white

crescent (Fig. 1). On the surface of the stripe ran many blood-vessels coming from the conjunctiva and terminating at the base of the white crescent. All around the fascicle and in the internal half of the limbus there existed a faint dotted zone of infiltration, *2mm* broad. Under the fascicle there was a small white circular subepithelial spot, about the size of a pin head. The pericorneal injection was very marked on the inner aspect of the limbus and advanced upon the faint rim on the cornea. The episcleral tissue at the internal canthus was also very red and inflamed.

In the outer and lower quadrant of the cornea another band of infiltration existed, which extended less than the internal and ended also in a larger gray-white crescent. The injection was much less at the external portion of the limbus and there was no trace of infiltration rim.

The left eye was normal.

Photophobia and blepharospasm subsided rapidly under the use of holocaine. Antiseptic wash, atropine, and hot compresses were instituted with good results. For the treatment of the skin condition the patient was referred to the dermatologist, who prescribed the proper internal and external medicaments.

With this treatment the outbreak of acne and the congestion of the skin subsided. At the same time the condition of the eye improved rapidly. The conjunctival injection subsided and the zone of faint infiltration around the fascicle and in the limbus became less noticeable.

On September 15th no photophobia or lacrymation was apparent. The internal fascicle became less vascular, did not progress further, and was more white and dense. The faint rim of infiltration and the white spot below have disappeared. The external fascicle remained in the same condition.

On September 20th, coincident with a new congestive attack of acne pustulosa in the skin, the eye became greatly irritated. Photophobia and lacrymation returned and the external fascicle progressed toward the center of the cornea by the enlargement of the crescent, which assumed a triangular form and stained slightly with fluorescine (Fig. 2). The vascular pencil is lying in a depressed, transparent furrow, which mirrors with the reflected images.

On September 22d there appeared upon the scleral conjunctiva at the external angle, an inflammatory nodule yellowish-white in color and of the size of a millet grain, sharply outlined and elevated upon the surrounding conjunctiva. Numerous blood-vessels converged to it from all directions. Two days afterwards the congestion and irritation of the skin diminished and the condition of the

eye improved. Cicatrization continued toward the internal fascicle, whose vessels diminished in number. The external fascicle on the contrary progressed steadily and its apex became larger. Powdered iodoform and a protective bandage were prescribed. On September 29th the outbreak of acne on the face terminated. The congestion of the plaques of rosacea subsides and desquamation begins. On the eye the bulbar conjunctiva recovered its normal color at the internal angle. Outside the episcleral nodule increased until it became the size of a wheat grain and its local vascularization became more marked. This nodule is firmly adherent to the sclerotic and the conjunctiva does not slide upon it. The internal fascicle is now entirely cicatrized; the blood-vessels become absorbed almost completely, leaving a white opaque band. The external fascicle appears to be stationary and the apex is less infiltrated.

Patient does not return for consultation until the 28th of October, having been compelled to go to his farm on important business for some days. During his absence, it appears, he continued treatment instituted for the eye, but neglected the skin condition, and a new outbreak of congestive acne came back. The eye is almost quiet; the scleral nodule is in the same condition. The vascular fascicle outside has not progressed, its triangular apex has disappeared, and the vessels run to its end.

In order to study the histological characters of the scleral nodule I performed the excision of a small piece under cocaine anæsthesia. The treatment of the skin condition was resumed and eight days afterwards the acne disappeared and the plaques of rosacea were much discolored. In the eye the episcleral nodule became small and finally disappeared.

At this stage cicatrization was rapidly progressing at the external fascicle and became completed in eight days, leaving a characteristic white leucoma, which almost reaches the pupillary margin although it is smaller than the internal stripe.

The patient is discharged with special caution not to abandon the treatment instituted for the skin condition. The histological examination of the excised nodule was made by Dr. Tomás G. Perrin, who gave the following account:

"The specimen sent for examination consisted of epithelium and dermis of the bulbar conjunctiva and part of the loose connective tissue of the episclera (Fig. 3).

"*Epithelium.* Presents the stratified pavement structure characteristic of the regions far away from the fornix. This stratification is notably increased by an hyperplastic

process, which has retained the normal orientation of the cells and the subepithelial basal membrane. Neoplastic lesions are not observed. In none of the numerous sections studied were there found any traces of acinous glandular formations (Krause's or Wolfring-Ciaccio's) nor tubular (or Henle's) nor utricular (or Manz's).

"*Dermis.* Rudimentary papillæ are visible on the sections. Disseminated on the conjunctival stroma there are numerous foci of infiltration, formed by lymphoid cells and lines of plasma cells. There are numerous blood-vessels, some of them newly formed with embryonic walls, which present congestive lesions and slight dilatations, which cannot be considered as a true telangiectatic condition. There is a considerable increase in fibroblasts with hypergenesis of connective tissue fibers, principally localized around the vessels."

Describing the symptomatology of the ocular rosacea all authors have pointed out the striking resemblance between rosacea keratitis and phlyctenular kerato-conjunctivitis. Although in the case I have just described it was not possible to observe the beginning of the keratitic inflammation, it is almost certain that it began with efflorescences or infiltrations at the limbus which became ulcerated and afterwards acquired a serpiginous character, with tendency to invade the center of the cornea. The patient himself clearly stated that "a white spot" was at first formed on the eye and then progressed toward the pupil. I was able to observe the extension upon the cornea of the external stripe, the brush of vessels trailing after the ulcer, and then the characteristic leucomas, which leave no doubt of the nature of the keratitis, a true fascicular keratitis complicating an acne rosacea of the skin.

According to Seo and Yamaguchi the vessels advance below Bowman's membrane, which is destroyed behind them, and sometimes they invade also the most superficial layers of the corneal stroma. As the vascular brush advances it is placed in a groove and the epithelium regenerating above it is easy to detect a semi-transparent furrow which mirrors on the reflected light and ends in a gray-white, triangular or crescent-shaped zone of infiltration whose border is slightly stained by fluorescine.

The internal infiltration existed probably about five months

before I saw the case. It became ulcerated again on the second attack, when he came to my office.

It is important to state that in this patient, contrary to the opinions of several authors, the ocular changes were intimately associated in their progress with the skin condition and that the improvement of the latter brought always a relief of the irritation and congestion of the eye, although, of course, the advance of the fasciculus was not checked.

Keratitis fascicularis has never been mentioned as a complication of rosacea ocularis. Its presence in this patient confirms the close relationship between phlyctenular keratitis and rosacea keratitis, because *the fasciculus has never been found associated with any other condition than phlyctenular keratitis.*

The ocular manifestations of acne rosacea, according to several authors, are as follows: In the *cornea* the lesions consist of gray-white infiltrations limited or diffuse, subepithelial, either similar to those of phlyctenular keratitis or much larger and deep, parenchymatous (Holloway, Capauner), surrounded by faint punctate zones of infiltration, which may progress by successive outbreaks, recurring readily and sometimes being covered with abundant blood-vessels (although less marked than in pannus phlyctenularis). Upon these infiltrations small superficial ulcers develop, which may sometimes be infected or acquire a serpiginous character. Erdmann has described a case of ulcus rodens (Mooren's). Blancke observed an ulcer which became wider and deep and was accompanied by hypopyon.

Corneal ulcers leave after healing flat or more commonly excavated scars which easily become reinfected during new outbreaks of ocular inflammation, coincident with inflammatory attacks on the skin. Sometimes the entire cornea may be opacified (Capauner).

The *iris* may become involved in some cases: hyperæmia only or true iritis (Caralt, Blancke).

In the *sclera* there is a formation of nodules or papules of variable size, which generally undergo absorption, and disappear without any sequelæ.

Rosacea keratitis differs clinically from keratitis phlyctenularis by the presence of the faint dotted infiltration area around

the corneal lesions, by the extension of the changes, its abundant vascularization, its preference for the inferior quadrant of the cornea, the complication with iritis, and the excavated form of the scars which result from corneal ulcers. But these clinical distinctions should not be sufficient to make the differential diagnosis, were it not for the existence of the skin changes, the rosacea and acne, and if the age of the patient did not exclude a true phlyctenular keratitis.

Let us consider what we know of the etiology of this last disease and ascertain if something similar is responsible for the appearance of ocular rosacea. We do not know definitely what is the cause which produces phlyctenular kerato-conjunctivitis. Is it an ectogenous or an endogenous infection? Is it a toxæmia or a toxi-infection? Bacteriological researches have proved that the efflorescence itself is sterile when recent. Axenfeld (11) long ago opposed the views of Bach, who considered staphylococcus as the cause of the infection, and asserts that this microbe being a normal host of the skin, only secondarily infects the conjunctiva.

More promising were the researches on the endotoxic origin of the phlyctenular keratitis. Many authors: Derby, D'Ayrens, Igersheimer, Weekers, Stephenson, Rosenhauch, and others have obtained with the general tuberculin test from 50% to 90% of positive reactions. Diagnostic injections of tuberculin sometimes produce an eruption of phlyctenes in the eye (Schutz and Videky, Feer, Stock, etc.). The old ophthalmoreaction proved itself positive not only in the form of conjunctivitis, but also as conjunctival phlyctenes and even as a keratitis.

Experimental researches made by Rosenhauch (12) have proved that in rabbits infected with tuberculosis, conjunctival phlyctenes can be produced by instilling in the conjunctival sac pure cultures of staphylococcus aureus, the conjunctiva being previously irritated; but he failed in obtaining them in normal rabbits by the irritation of the conjunctiva and the use of staphylococcus cultures. Weekers (13) was able to produce also phlyctenules on the conjunctiva of tuberculous rabbits by the instillation of tuberculin into the eye, and asserts that the external action of the staphylococcus is not necessary when the tuberculous toxæmia exists.

Lately Rubert (14), repeating the experiments of Rosenhauch and Weekers, has confirmed the conclusions of the latter in regard to the positive effect of the instillation of tuberculin, but adds that phlyctenules can also be produced by the action of the toxins of staphylococcus aureus on the eye, it being always necessary in this latter case that a previous general tubercular infection exists.

These experiments seem to confirm the idea of the scrofular or rather tubercular origin of the eye changes in phlyctenular kerato-conjunctivitis, and in fact in a great number of children that react to tuberculin, clinical evidences of tuberculosis can be found. But there are undoubtedly many other cases in which the patient's general health seems to be normal and no traces of scrofulosis can be found. In these cases, however, general autointoxication by faulty diet and intestinal disorders or some local infection as nasal catarrh or adenoids are at fault.

There are other children in whom without clinical evidences of tuberculosis the ocular efflorescences are accompanied by eczema of the face and the other signs of Czerny's "exudative diathesis." According to our present knowledge therefore two factors seem to be necessary for the production of eye phlyctenes: 1st. A general toxæmia by the tuberculous bacilli or some autointoxication specially of intestinal origin. 2d. An irritative local agent which may be the staphylococcus or the tubercle bacillus or perhaps the streptococcus in some cases, as suggested by Saboureaud.

The same factors account for the development of phlyctenules in the case of rosacea ocularis? We must certainly discard tuberculous toxæmia as the cause of rosacea in the eye. There is no relation between them. But we probably have at the bottom of the ocular rosacea a toxæmia either of intestinal or, as certain authors suggest, of genital origin.

Let us consider in what way the two characteristic elements of acne rosacea work upon the membranes of the eye.

There is not a single case recorded of *simple rosacea*, that is of congestive or telangiectasic patches on the face without acne, which had been accompanied with ocular manifestations. In all recorded cases there was always infection of the sebace-

ous glands, *i. e.* inflammatory acne, which had certainly been preceded by cutaneous seborrhea.

On the other hand acne polymorphus alone, without rosacea, when it settles in the skin of the face never gives rise to conjunctival or corneal lesions. This is easily explained, as the acne being due to a special infection of the sebaceous glands of the skin, which begins with seborrhea and sometimes is attended with secondary staphylococcus infection of the gland and follicle, cannot be started in the conjunctiva in which there are no sebaceous glands. Therefore if the ocular manifestations do not exist when the two elements of acne rosacea are separated and only come up when these elements are combined, its appearance must be due to the fusion of their respective etiological factors.

The rosacea plaque itself has been attributed to several factors. Some authors claim it is purely mechanical, and produced by the compression of the veins in the cranial foramina. Others ascribe it to a paretic condition of the vascular walls, very closely allied to the complex factors which produce varicosities of the lower extremities. The Vienna school supports the theory that it is *angio-neurotic* in origin, and its cause must be looked for in all processes which, directly or by the intervening action of the centers and vasomotor nerves which govern the circulation of the blood in the face, give rise to the dilatation of the capillaries and small veins in the skin. Among these processes are to be mentioned the repeated congestion of the face which is produced after copious meals in persons whose digestion is imperfect and who generally have cold extremities and hot face. In its ultimate development gastro-intestinal and hepatic troubles are much to be blamed, and many assert also that menstrual disturbances and exaggerated continence play some rôle. But all these factors are impotent to produce true acne rosacea if the skin is intact and seborrhea does not exist. On the other hand when the sebaceous glands become infected with the microbacillus seborrheicus, if the patient suffers from gastro-intestinal troubles and autointoxication occurs, it is almost certain that paroxysmal outbreaks of discrete acne pustules, first of small size and then larger, will come on the plaques of rosacea. These pustules are produced by the late infection

of the seborrheic glands and orifices of the hair follicles with the staphylococcus. Therefore, it is probable that the production of ocular manifestations in acne rosacea may be due to the existence of a general toxæmia and to the action of some external irritant as the toxins of the staphylococcus and perhaps of other microörganisms existing in the skin, which are conveyed to the eye by soiled hands, dirty handkerchiefs, etc.

Ocular rosacea is frequently accompanied by nasal troubles. Stellwagon has called attention to its coincidence with certain diseases which give rise to obstruction of the nasal fossæ such as polypi, hypertrophy of the head of the median turbinate, or hypertrophic rhinitis. The infection of the nasal mucous membrane by the streptococcus is frequent in childhood and in adults an infection by the staphylococcus exist sometimes.

Many authors consider the acne rosacea ocularis to be due to nervous or trophic changes. Holloway ascribed the disease to a nervous lesion localized in the territory of distribution of the fifth nerve, specially in the maxillary branch. Burton Chance (15) suggests that there are trophic changes in the terminal nerves of the cornea. Verhoeff believes that the corneal lesions are of neuropathic origin and due to impulses of the Gasserian ganglion passing along the conjunctival nerves, these lesions being of the same origin as certain small peripheral corneal infiltrations associated with herpes facialis. However he has never been able to demonstrate any reduction in the sensibility of the cornea in the periphery. Caralt (16), who has made a detailed study of ten cases of rosacea ocularis (in the other four cases he mentions there were no ocular lesions), believes that the ocular changes depend on an angioneurotic process, reflex in origin, similar to that of the skin and produced by autointoxications which are due either to chronic diseases of the digestive apparatus or to functional disturbances of the glands of internal secretion of the genital apparatus. For him ocular rosacea is not of bacterial origin but simply an endotoxic condition, which must be separated from the phlyctenular keratitis. However he never found—except in one of his cases—anæsthesia of the conjunctiva or cornea nor has he ever observed eruption of vesicles along the branches of the trigeminus.

We must remember on this account that latest researches have found the Gasserian ganglion infected by some blood-carried bacteria in cases of neuritis.

In regard to the pathogenesis of fascicular keratitis we can say nothing in concrete. Addario (17), who has examined bacteriologically twelve patients affected with this complication, has found in all, except one, the staphylococcus, but this bacterium is by no means specific; it is found also, as we have said, in the efflorescence which never becomes serpiginous.

REFERENCES.

1. CAPAUNER. *Zeitschrift für Augenheilkunde*, vol. x., 1903, p. 126.
2. KUNTZ. *Postep Okulist*, August, 1905.
3. WICHERCKIEWICZ. Inaugural Dissertation, 1905.
4. SCHIRMER. "Ueber keratitis ex akne rosacea." *Zeitschrift für Augenheilk.*, vol. xv., 1906.
5. BLANCKE. Inaugural Dissertation, 1906.
6. SYDNEY STEPHENSON. *Transactions Ophthalm. Society United Kingdom*, vol. xxvi., 1906.
7. ERDMANN. *Archiv für Augenheilkunde*, vol. xvii., p. 351.
8. HOLLOWAY. "The Ocular Manifestations Associated with Acne Rosacea. *Archives of Ophthalmology*, vol. xxxix., p. 2.
9. CARALT. "Acne Rosacea y queratitis." *Archivos de Oftalmologia Hispano-Americanos*, vol. xiii., 1913.
10. GOLDSMITH. *The Ophthalmoscope*, vol. v., 1907, p. 20; CRUISE. *Transactions Ophthalm. Society of the United Kingdom*, 1908, p. 45; PETERS. *Klinische Monatsblätt. f. Augenh.* (abstr.), vol. l., p. 490; 1910; HILBERT. *Muenchener medizinische Wochenschrift*, vol. xviii., DARIER. *La Clinique ophtalmologique*, vol. xviii., p. 2.
11. AXENFELD. "Was wissen wir ueber die Entstehung der phlyktänulären Augenentzündungen." Heidelberg Congress, 1897. *Die Bakteriologie in d. Augenheilkunde*, Jena, 1909.
12. ROSENHAUCH. "Ueber das Verhältniss phlyktänulären Augenentzündungen zur Tuberkulose." *Archiv für Ophthalm.*, vol. lxxvi., 2, 1910.
13. WEEKERS. "L'exanthème de la conjonctivite phlyctenulaire envisagé comme une toxituberculide." *Archives d'ophtalmologie*, May, 1909. Also *Thèse inaugural*, Bruxelles, 1911.
14. RUBERT. "Ueber die aetiologie der phlyktänulären Augenentzündungen." *Klinische Monatsblätter für Augenh.*, vol. l., 1912, p. 273.
15. BURTON K. CHANCE. Section on Ophthalmology, College of Physicians of Philadelphia. *Ophthalmic Record*, vol. xxi., p. 144.
16. CARALT. *Loc cit.*
17. ADDARIO. *Archivio di Ottalmologia*, vol. xii., July–August, 1904.

THE PRODUCTION OF CATARACT.

By Dr. W. E. BURGE, Urbana, Ill.

Physiological Laboratory of the University of Illinois.
(From experiments carried out at Nela Research Laboratory.)

(*With seven figures on Text-Plates II–III.*)

IT is recognized that cataract is of more frequent occurrence among people living in the tropics, glass-blowers, diabetics, and elderly persons than among people generally. Some attribute the prevalence of cataract in the tropics to the excess of ultra-violet radiation in tropical light, while others attribute it to the heat. That ultra-violet plays a part in the production of cataract in the tropics is rendered very probable by the fact that cataract in the tropics as a rule begins in the lower quadrant of the lens which is exposed to the light coming directly from the sky, and hence richer in ultra-violet radiation than the light reflected from the ground, to which the upper quadrant of the lens is exposed. The prevalence of cataract among glass-blowers is usually considered to be due to the extreme heat to which the eyes of the glass-blowers are exposed. The prevalence among diabetics is explained on the assumption that the abnormal amount of sugar in the liquids of the body extracts water from the lens, thus rendering it opaque or cataractous. The prevalence among elderly people is attributed to the fact that the lens continues to increase in size throughout life, hence, with advance in years the nucleus of the lens is further and further removed from the source of nutrition, and this condition, it is claimed, predisposes to nuclear opacity. If these generally accepted causes for cataract are examined critically, certain questions arise as, for example, how is it possible for the temperature of the eyes of people living in the tropics or of glass-blowers to

ILLUSTRATING DR. BURGE'S ARTICLE ON "THE PRODUCTION OF CATARACT."

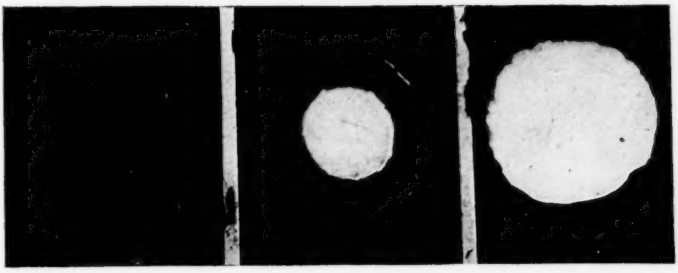


FIG. I.—Photograph of crystalline lenses. A, normal transparent lens; B and C, opaque lenses. B, nuclear opacity produced by immersion in 15 per cent. potassium chloride; C, cortical opacity produced by immersion in 5 per cent. calcium chloride.

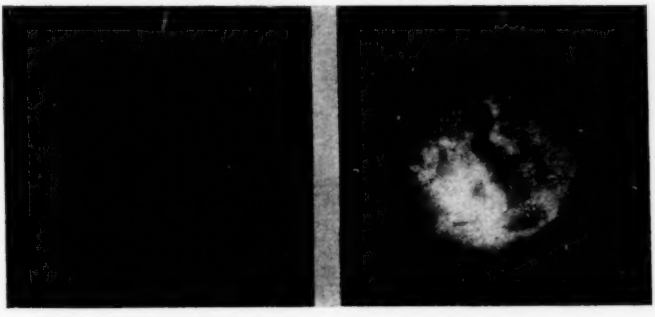


FIG. II.—(1) is a photograph of the square of glass covered with egg white, the central area of which had been exposed to ultra-violet radiation. (2) is a photograph of the same square of glass after it had been immersed in a 0.1 per cent. calcium-chloride solution.

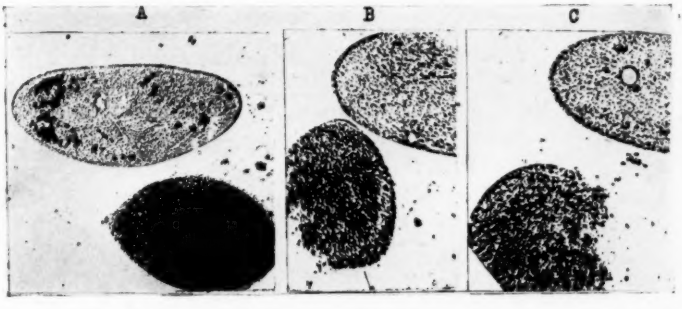


FIG. III.—Microphotographs of paramecia. The upper ones under A, B, and C are the normal transparent living animals: the lower one under A was killed by heating to 90° C.; the lower one under B, by heating to 45° C; the lower one under C, by exposure to ultra-violet radiation.

rise sufficiently high to produce an opacity of the lens without permanent injury to other parts of the eye, or how does the deprivation of nutrition render a transparent body, such as the lens, opaque?

The most apparent change in the lens in cataract is its loss of transparency, hence, in seeking for the cause of the disease the thing to be determined is the cause of the opacity of the lens. Chemically the most conspicuous difference between cataractous and normal lenses is to be found in the inorganic constituents. In the table below are given the results of analyses (1)

TABLE I.

AVERAGE PERCENTAGE COMPOSITION OBTAINED BY ANALYZING THE COMBINED ASH OF A LARGE NUMBER OF LENSES.

	Percentage Ca in Ash	*Percentage Na in Ash*	*Percentage Si in Ash*
Normal adult human lens	?	?	0
Normal adult pig's lens	0.08	6.67	0
Embryo human lens	?	?	0
Cataract human lens (U. S. A.)	12.50	23.82	0
Cataract human lens (India)	6.00	25.06	3.63

of normal, as well as cataractous lenses from the United States and from the tropics (India). It may be seen that the amount of calcium and sodium salts in the cataractous lenses was increased over the normal and that there was a very appreciable amount of silicon in the cataractous lenses from India, whereas there was none in those from the United States. Silicates may possibly be accounted for in the cataractous lenses from India by the fact that silicious earths form a part of the diet of certain classes of the natives. The increase in inorganic salts in cataractous lenses suggested that the salts might be a factor in the production of cataract, hence experiments were carried out to determine if an opacity of isolated lenses could be produced by immersing them in solutions of these salts.

Effect of Salt Solutions on Isolated Lenses. One set of lenses was immersed in 15% sodium chloride and another set in 5% calcium chloride for fifteen hours. At the end of this time

the lenses were removed from the solutions and photographed. The photograph is shown in Figure I. A is the normal transparent lens, B the one immersed in 15% sodium chloride, C the one immersed in 5% calcium chloride. It may be seen that sodium chloride produced nuclear opacity without affecting the transparency of the cortex, and it was found upon cutting the lens in two that calcium chloride produced cortical opacity without affecting the transparency of the nucleus. It was also found that potassium chloride produced nuclear opacity without affecting the transparency of the cortex of the lens.

If the inorganic salts are involved in the production of cataract, nuclear and cortical, the sodium salts function in the production of nuclear and the calcium salts in the production of cortical cataract. The objection to the assumption, however, that either of these salts can of themselves produce cataract in a living animal is the fact that the strength of the solutions necessary to produce an opacity in the isolated lens is far stronger than could ever occur in a living animal, hence if the inorganic salts are involved at all in the production of cataract it must be conjointly with some other factor. Since the chief function of the crystalline lens is the transmission of radiant energy, the following experiments were carried out to determine if radiant energy acting alone or conjointly with these salts could produce an opacity of the lens or cataract.

Effect of Infra-Red. Sir William Crookes (2) concludes that glass-blower's cataract is due to the long waves of the spectrum. This conclusion was based on the fact that he found the radiation from molten glass in the glass-blower's furnace to be very rich in red and infra-red. In the present instance experiments were carried out to determine if it were possible to produce an opacity of the lens, or cataract, by the direct exposure of excised pig and ox lenses to the radiation from an electric furnace, which is particularly rich in infra-red. Lenses fitted into floats made of thin rings of cork were almost submerged in open-mouthed glass vessels containing egg-white, blood serum, aqueous and vitreous humors, respectively. Each glass vessel was placed in a tank of running water with its mouth slightly above the surface of the water. An electric furnace operating at 1000° C. was inverted and

ILLUSTRATING DR. BURGE'S ARTICLE ON "THE PRODUCTION OF CATARACT."

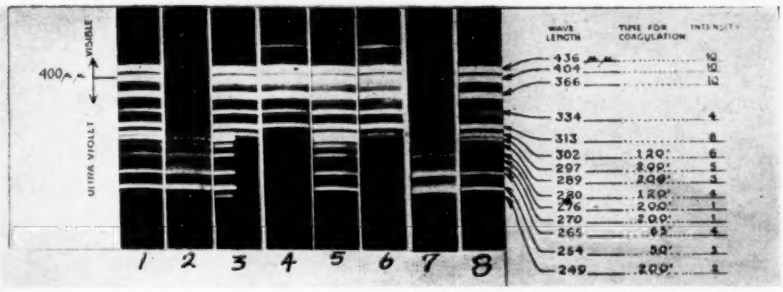


FIG. IV.—Photograph of spectra of small quartz mercury-vapor burner. (1) made on photographic plate; (2) made on lens protein; (3) made on photographic plate one-half of the slit of the spectrograph being covered with the cornea of a rabbit; (4) through layer of lens protein 1*mm* thick; (5) through aqueous humor 1*mm* thick; (8) photograph of spectrum made on photographic plate; (7) made on egg white; (6) made on photographic plate through egg white 1*mm* thick.

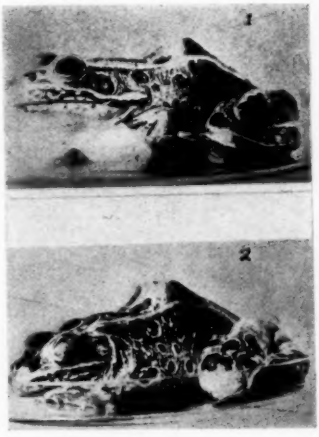


FIG. V.—Frog (1) living in tap water and exposed to ultra-violet radiation for 5 hours. Frog (2) living in 0.2 per cent. sodium-silicate and exposed to ultra-violet radiation for 5 hours.

FIG. VI.—Fish (1) living in tap water and exposed to ultra-violet radiation for 12 hours. Fish (2) living in 0.1 per cent. sodium silicate and exposed to ultra-violet radiation for 12 hours. Fish (3) living in 0.1 sodium silicate and exposed to ultra-violet radiation for 24 hours.

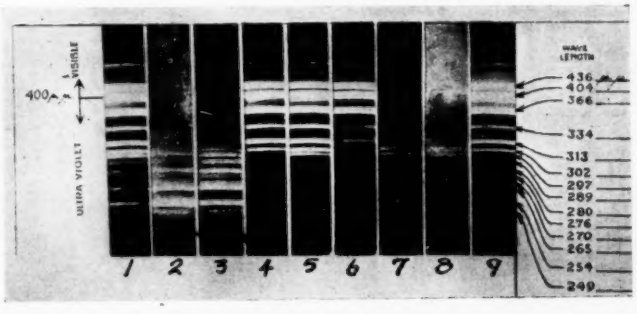


FIG. VII.—Photograph of spectra of the small quartz mercury-vapor burner and of the large quartz mercury-vapor burner. (1) that of the small burner; (9) that of the large burner, made on a photographic plate. (2) that of the small burner; (8) that of the large burner, made on egg white. (3) that of the small burner; (7) that of the large burner, made on lens protein extracted with 0.1 per cent. calcium-chloride solution. (4) that of the large burner made through cornea of the rabbit; (5) made through glass 1*mm* thick; (6) through glass 5*mm* thick.

placed directly over the lenses at a distance of 15*cm*. The materials were thus exposed for many hours without the production of an opacity either in the lenses or in the media. Other experiments were carried out similar to those just described, except that the furnace was placed 5*cm* from the surface of the lenses. Under these conditions the lenses could be rendered opaque in about ten minutes. However, on placing the bulb of a thermometer on a lens thus rendered opaque it was found that the temperature in the region of the lens was about 80° C. Hence the opacity thus produced was evidently due to the heat effect and not to the red and infra-red radiation.

Effect of the Visible Spectrum. Lenses were arranged on floats similar to those described above and almost completely immersed in similar media, viz., egg-white, blood serum, aqueous and vitreous humors. By means of a bi-convex glass lens 10*cm* in diameter and with a principal focal distance of approximately 30*cm* the filament of a nitrogen-filled tungsten lamp operating at 2000 cp. was focused on the lenses. Exposures for many hours were made. In no case was an opacity of the lenses produced.

Similar experiments were made by focusing the image of the sun on the lenses. Opacity in this manner could be produced in a very few minutes, but it was found in every case that the temperature of the crystalline lens was raised sufficiently high to coagulate its protein.

The conclusion is therefore drawn that an opacity of the lens, or cataract, cannot be produced by radiation from the region of the visible spectrum or of the infra-red provided the temperature effect be excluded.

Effect of Ultra-Violet Radiation. Schanz and Stockhausen (3) studied the radiation from the glass-blower's furnace and found, contrary to the findings of Crookes, that it was rich in ultra-violet radiation, hence they concluded that glass-blower's cataract is due to the short waves.

Experiments were devised by the writer to determine if it were possible to produce an opacity in the crystalline lens by direct exposure to the radiation from the quartz mercury vapor arc. Lenses were introduced into quartz tubes previously filled with egg-white, blood serum, aqueous and

vitreous humors, respectively. The diameter of these quartz tubes was slightly less than the diameter of the lenses, so that each tube was filled in an horizontal direction by means of the lens. The tubes were closed with rubber stoppers and placed horizontally in a tank of running water at a depth of 1*cm* beneath the surface of the water and 5*cm* below a quartz mercury-vapor burner operating at 140 volts, 3.3 amperes and about 2500 cp. The egg-white and the blood serum were firmly coagulated after twenty hours' exposure, while the aqueous and vitreous humors had become turbid. The immersed lenses in all the tubes, however, were as transparent after such an exposure as they were at the beginning of the experiment. At the end of one hundred hours' exposure there was practically no change in the transparency of the lenses. Other experiments were carried out exposing egg-white, blood serum, aqueous and vitreous humors in the quartz tubes without the immersed lenses. At the end of twenty hours' exposure the egg-white and the blood serum were coagulated, but the transparency of the aqueous and the vitreous humors was affected very little, if any, by such an exposure. These exposures were continued for one hundred hours, and at the end of this period the aqueous humor was as clear as it was at the beginning of the experiment, while the vitreous humor had been rendered very slightly cloudy.

The conclusion is therefore drawn that ultra-violet radiation which is of sufficient intensity to render egg-white and blood serum firm coagula in a few hours will not affect the transparency of the crystalline lens or of the aqueous and vitreous humors in one hundred hours' exposure. Dreyer and Hanssen (4) found that ultra-violet radiation will precipitate not only egg-white and blood serum, but practically every other protein and related substance. Thus it would appear that the lens protein and the proteins of the aqueous and vitreous humors form a conspicuous exception in that it is practically impossible to coagulate these by means of ultra-violet radiation, under similar conditions.

Effect of Infra-Red and Visible Spectrum on Lenses in Salt Solutions. Lenses were immersed for two hours in 0.1% calcium chloride, 0.1% magnesium chloride, 0.1% sodium silicate, and 1.0% dextrose, respectively. They were then

exposed to the radiation from the electric furnace, the tungsten nitrogen-filled lamp, and the sun. Exposures were made as in the preceding experiments without affecting the transparency of the lenses or of the media, provided the heat effect was excluded.

Effect of Ultra-Violet Radiation on Lenses in Salt Solutions. In the same manner, quartz tubes containing similar media and immersed lenses were prepared and exposed to the radiation from the quartz mercury-vapor burner. It was found that the solution in the quartz tube containing a lens immersed in the 0.1% calcium chloride became turbid after twenty-five minutes' exposure. The portion of the lens on the side next to the burner had become an opaque mass after seventy-two hours' exposure, whereas the transparency of the half of the lens away from the burner was only slightly affected. The same thing happened on the exposure of the lenses immersed in 0.1% magnesium chloride, in 0.1% sodium silicate, or 1.0% dextrose, except that the effect was not so marked and was not produced so quickly as when calcium chloride was used.

The conclusion is therefore drawn that ultra-violet radiation cannot precipitate lens protein in its native state but that it can precipitate it and hence produce an opacity or cataract when the lenses are immersed in solutions of those salts found to be greatly increased in cataractous lenses. The following experiments were carried out to show that the action of ultra-violet radiation, in precipitating lens protein consists in modifying it so that the salts can combine with the protein to form a coagulum.

Effect of Ultra-Violet Radiation on Proteins. Egg-white was poured on a glass plate 6*cm* square and permitted to dry. A piece of cardboard the size of the plate with a circle cut from its center approximately 2*cm* in diameter was fitted over the plate. The preparation was exposed for thirty hours to the radiation from the quartz mercury-vapor burner at a distance of 10*cm*. It will be noted that only the central circular area of the egg-white was exposed to the radiation since the peripheral portion was covered by the cardboard. At the end of the thirty hours' exposure the cardboard was removed and the plate was photographed. Figure II. (1) is the photograph. It may be seen that at this time there was no apparent differ-

ence between the exposed central area and the unexposed peripheral area of the layer of egg-white. The plate was then immersed in a 0.1% calcium chloride solution. (2) is a photograph of the plate after it had been immersed in the solution for one hour. It may be seen that the calcium chloride precipitated the proteins of the egg-white in the circular area where it had been exposed to the radiation, while it did not affect the egg-white where it had not been exposed. Calcium nitrate was tried in the same manner and found to have a similar effect in precipitating the protein of the egg-white previously exposed to the radiation.

A thin layer of lens material was made by pressing three fresh pig lenses between two quartz plates. The cardboard with a circular area cut from its center was placed over the preparation and this was exposed to the radiation from the quartz mercury-vapor burner for thirty hours as the egg-white had been. At the end of this time there was no apparent difference between the exposed circular area and the unexposed peripheral area of the lens material, both being transparent. When, however, the preparation was immersed for about an hour in 0.1% calcium chloride solution the exposed circular area became an opaque mass, while the unexposed peripheral area remained transparent. The conclusion may be drawn that ultra-violet radiation coagulates protein by changing it in such a way that salts such as those of calcium can combine with it to form a coagulum. In this respect it would seem that ultra-violet radiation acts on protein in very much the same way that certain enzymes act on it. It is known, for example, that rennin changes the protein in milk, caseinogen, in such a way that calcium salts can combine with it to form an insoluble curd, casein.

Further Analysis of the Action of Ultra-Violet Radiation. The following experiments were carried out to show that ultra-violet radiation not only changes proteins so that certain salts can combine with them to form a precipitate, but that it also changes the staining property of the protein and that the change produced in the protein is molecular in character and not atomic.

A thin film of egg-white was poured on a glass plate and permitted to dry. A piece of cardboard the size of the plate

with a circle cut from its center approximately *2cm* in diameter was fitted over the plate. The preparation was exposed for twenty hours to the radiation from the quartz mercury-vapor burner at a distance of *10cm*. It will be noted that only the central circular area of the egg-white was exposed to the radiation, since the peripheral portion was covered by the cardboard. At the end of the twenty hours' exposure the cardboard was removed and the plate was immersed in a weak solution of an aniline dye, rhodamin. The central circular area that had been exposed to the radiation was intensely dyed, whereas the unexposed peripheral area did not take the dye. A thin layer of the crystalline lens was tried in a similar manner with the same result that was obtained in using egg-white.

The conductivity of a thin layer of egg-white as well as of lens material was determined before being exposed to ultra-violet radiation, during the exposure and after it. Precautions were taken to avoid evaporation and to maintain a constant temperature during the exposure. It was found that the exposure did not alter the conductivity, hence it is evident that the change produced in protein by the short wave-lengths of the spectrum so that certain salts can combine with it to form a precipitate is molecular in character and not atomic.

The Action of Ultra-Violet Radiation in Killing Living Cells. The following experiments present evidence that ultra-violet radiation acts on living cells in the same manner that it acts on fresh dead cells, and that the destructive effect of ultra-violet radiation is due to the coagulation of the protoplasm of the living cells. Several drops of water containing great numbers of unicellular organisms, paramecia, were introduced into a shallow glass vessel and covered with a quartz plate. The glass vessel was then placed on a block of ice under a quartz mercury-vapor burner operating at 140 volts and 3.3 amperes, at a distance of *5cm*, and in this position the organisms were exposed for twenty minutes. A drop of the liquid containing the dead paramecia was mixed with a drop containing living ones on a glass plate and covered with a cover glass. Having located under a microscope a dead organism and a living one lying close together a micro-photograph was made of them. Similarly, micro-photographs were made of living

paramecia and of paramecia killed by heating to 45° C. and 90° C. respectively. These photographs are shown in Figure III. The upper organisms under A, B, and C are living transparent animals; the lower one under A was killed by heating to 90° C., the lower one under B by heating to 45° C., and the lower one under C by exposure to ultra-violet radiation. By comparing the lower organisms under B and C it may be seen that there is no difference in the appearance of these two organisms, both being slightly more opaque than the living organisms. The lower organism under B was killed by the coagulation of its protoplasm by heat, and since there is no difference in the appearance between this one and the lower organism under C, which was killed by exposure to ultra-violet radiation, it would seem to be fair to assume that the latter was killed by the coagulation of its protoplasm by the radiation. By comparing the lower organism under A with that under B it may be seen that the lower one under A is very much more opaque than the lower one under B. This greater opacity is explained by the fact that proteins are more firmly coagulated at a temperature of 90° C. than at a temperature of 45° C. It will be noticed also that the lower organisms under B and C which were killed by heating to 45° C. and by exposure to ultra-violet radiation respectively had begun to disintegrate, while the lower one under A had not begun to do so because of the firmer coagulation of the protein of this organism heated to the higher temperature.

Henri (5), Hertel (6), and others observed that when protozoa were exposed to ultra-violet radiation the body became swollen, drops of water appeared on the surface, and the organisms finally disintegrated, but they did not observe any coagulation produced by the radiation. The failure of these observers to obtain observable coagulation in the organisms was due to the fact that the radiation to which they exposed the organisms was not of sufficient intensity to coagulate firmly the protoplasm. If paramecia are heated to 40° C. they are killed after a time, but very little indication of coagulation is produced as is indicated by the fact that there is very little decrease in the transparency of the organisms thus killed. By increasing the temperature, however, at which the organisms are killed, the protoplasm becomes firmer

and the animals more opaque. Similarly by killing the organisms by exposure to ultra-violet radiation of low intensity, a very inconspicuous amount of the coagulation is produced, and hence there is very little change in the transparency of the organisms. If the intensity of the radiation is increased, however, the coagulation of the protoplasm becomes more marked with the resulting increase in the opacity of the animals.

Action of the Different Wave Lengths in the Ultra-Violet Region of the Spectrum. An extract of twelve pig lenses was made with 25*cc* of 0.1% calcium chloride solution and filtered through a coarse-grained filter. Five *cc* of this fairly clear filtrate were introduced into a circular quartz cell made of two quartz disks having between them a ring of hard rubber 0.8*mm* thick with an inside diameter of 3.8*cm*. By means of a small quartz spectrograph the radiation from a quartz mercury-vapor burner operating at seventy volts was focused on the lens extract in the quartz cell. The slit of the spectrograph was 1*mm* wide and the quartz burner was 3*cm* from the slit.

Figure IV. (1) is a photograph of the spectrum that was focused on the lens extract. (2) is a photograph of the lens extract after the spectrum had been focused on it for thirty hours. The coagulated line of lens protein, where the spectral line of wave length 254μμ was focused, appeared after fifty minutes' exposure; that where the spectral line of wave length 265μμ was focused, appeared after sixty-five minutes' exposure. The remaining lines of coagulated lens extract appeared after about two hundred minutes' exposure. (3) is a photograph of the spectrum made on a photographic plate with half the slit of the spectrograph covered with the cornea of a rabbit. It may be seen that the cornea transmits wave lengths as short as 297μμ and 302μμ and in (2) it may be seen that these wave lengths are effective in changing the protein of the lens so that calcium salts can combine with it to form a coagulum. (4) is a photograph of the spectrum made through a layer of the lens extract 1*mm* thick. It may be seen that the extract absorbs all wave lengths shorter than 313μμ and in (2) it may be seen that all of these absorbed short wave-lengths are effective in coagulating the protein of the lens extracted with

0.1% calcium chloride solution. (5) is a photograph of the spectrum through a layer of aqueous humor *1mm* thick.

In another experiment egg-white was introduced into the same quartz cell that had been used with the lens extract. (8) is a photograph of the spectrum of the quartz mercury-vapor burner. (7) is a photograph of the region of the quartz cell containing the egg-white where the spectrum had been focused for thirty hours. (6) is a photograph of the spectrum through a layer of egg-white *1mm* thick. It may be seen that the egg-white absorbs wave lengths shorter than 302μμ and that all these absorbed wave lengths are effective in coagulating the proteins of the egg-white. The periods of time required for the formation of the lines of coagulated egg-white where the spectral lines were focused are indicated in Figure IV., under "time for coagulation." It may be seen that the time required for the coagulation of egg-white by the different spectral lines is the same as that required for the coagulation of the modified lens protein by the corresponding lines.

The Production of Anterior Eye Trouble in Living Animals by Means of Ultra-Violet Radiation. One batch of six frogs was kept living partially immersed in 0.2% sodium silicate, another batch in 0.8% calcium chloride, another in 1.0% dextrose, another in tap water for fifteen days. At the end of this time one eye of each frog was exposed one hour each day for five successive days to the radiation from a quartz mercury burner operating at 140 volts, 3.3 amperes, and 2400 cp. at a distance of *20cm.* Photographs of the frogs were made fifteen days after the exposures. Figure V., frog (1) had been living partially immersed in tap water previous to the exposures. Frog (2) had been living partially immersed in 0.2% solution of sodium silicate previous to the exposures. It may be seen that the eyelid of the frog living in the solution of sodium silicate had been converted by the radiation into an opaque mass, while that of the frog living in tap water was very little injured. The solution of calcium chloride had the same effect as the solution of silicate. The dextrose was effective but not so much as either of the other solutions. The conclusion may be drawn that salts such as are found to be greatly increased in human cataractous lenses increase the

effectiveness of ultra-violet radiation in producing anterior eye trouble.

It is a common experience that the skin sunburns more easily and quickly when it is wet than when it is dry. It is probable that if the skin is dry when it is exposed to the sunlight, the ultra-violet radiation in the sunlight changes the protein of the cells of the skin in such a way that salts such as those of calcium in the lymph bathing the cells can combine with it to form a coagulum. If the skin is wet with ordinary fresh or salt water the salts in the water facilitate the process by combining with the proteins of the cells modified by the ultra-violet radiation.

The Production of Cataract in Living Animals by Means of Ultra-Violet Radiation. An attempt was made to increase in the fluids of the body of living animals and hence in the eye media the salts found to be greatly increased in human cataractous lenses with the hope that on exposure of the eyes of these animals to ultra-violet radiation cataract would develop. Many observers have demonstrated that it is impossible to produce an opacity of the lens or cataract in the normal living animal by exposure of its eyes to ultra-violet radiation. Moreover, it is shown in this paper that it is not possible to produce an opacity even in excised pig lenses by exposing them directly to the radiation from a quartz mercury burner for very long periods of time. Fish were chosen for the experiment because they could be kept alive in the solutions of salts desired. One batch of goldfish was kept in 0.8% calcium chloride solution, another in 0.8% calcium nitrate solution, another in 1% dextrose, another in 0.1% sodium silicate for ten days. At the end of this time each fish in its turn was introduced into a small box with a quartz window in one side. In practice four of these boxes were used so that one eye of each of the four fish was exposed simultaneously. Fresh cool water was kept circulating through these boxes during the exposures. The boxes containing the fish were adjusted so that the quartz windows were 15*cm* from the quartz mercury-vapor burner operating at 140 volts, 3.3 amperes, and 2400 cp. In this manner one eye of each fish was exposed to the radiation. Each exposure was of six hours' duration. After the exposure, the batches

of fish were replaced in the solutions from which they had been removed. For comparison, the eyes of fish living in tap water were exposed in the same manner and for a similar length of time as those living in the salt solutions. As a rule a slight opacity in the cornea of the eye exposed appeared about fifteen hours after the first exposure. It was assumed that this opacity did not develop during the exposure because there was not sufficient salt present in the cells of the cornea to combine with the protein modified by the radiation to form a coagulum. However, at the end of twelve or fifteen hours a sufficient quantity of salt had collected, owing to the diffusion of the salt from the blood stream into the cornea, and had combined with the modified protein to precipitate it and hence an opacity of the cornea was produced. This assumption would seem to explain the so-called "latent period," *i. e.*, the time elapsing between the exposure of one's eye to ultra-violet radiation and the time when the painful effect is felt. In most of the fish a slight clouding appeared about two days after the first exposure in the lens of the eye exposed.

Ten days after the first exposure the eyes of the fish were exposed again for another six-hour period. At the time of this second exposure as a rule an opacity of the cornea and of the lens of the fish living in the salt solutions had increased while the opacity of the cornea of the fish living in tap water had practically cleared up. Several hours after the second exposure as a rule the opacity of the lens and of the cornea of the fish living in the salt solutions became more marked. An opacity of the cornea of the fish living in tap water developed also but this was slight and cleared up in a few days while that of the fish living in the salt solutions increased.

After the second exposure no prescribed rule as to time for the third exposure can be laid down. In order to clear up the opacity of the cornea of the fish in the different salt solutions it was necessary to transfer them to tap water. As a rule the opacity of the cornea cleared up in a few days while the lens remained opaque. By nursing, by exposing to ultra-violet radiation, by transferring back and forth from salt solution to tap water, it was possible to obtain fish in the condition indicated in Figure VI. Fish (1) had been living in tap water for thirty days and had been exposed to ultra-violet

radiation for two six-hour periods or twelve hours. Fish (2) had been living in 0.1% sodium silicate for twenty-eight days and had been exposed to ultra-violet radiation for two six-hour periods or twelve hours. Fish (3) had been living in 0.1% sodium silicate for forty-two days and had been exposed to ultra-violet radiation for four six-hour periods or twenty-four hours.

It may be seen that the lens of fish (3) living in the silicate solution and exposed to ultra-violet radiation for twenty-four hours had become perfectly opaque; that of fish (2) living in the same solution but exposed to ultra-violet radiation for twelve hours had become partially opaque, while the lens of fish (1) living in tap water and exposed to ultra-violet radiation for twelve hours was practically clear.

In Figure VII. are shown the photographs of the spectra of the small quartz mercury-vapor burner operating at 70 volts and that of a large quartz mercury-vapor burner operating at 140 volts. Photographs showing the effects produced by focusing these spectra on egg-white and on lens protein are also given in order to show that the most effective regions of the two spectra in precipitating protein are different. (1) is the photograph of the spectrum of the small quartz mercury-vapor burner made on a photographic plate, (9) is a photograph of the spectrum of the large quartz mercury-vapor burner made on a photographic plate also. By comparing these two spectrograms it may be seen that the spectral lines in the extreme ultra-violet region of the spectrum are much more intense in (1) than in (9). (2) is a photograph of the cell containing egg-white on which the spectrum of the small quartz burner had been focused for thirty hours. (8) is a photograph of the quartz cell containing egg-white on which the spectrum of the large burner had been focused for the same length of time. By comparing (2) and (8) it may be seen that the egg-white was coagulated in (2) where the spectral lines of wave lengths 302$\mu\mu$ to 249$\mu\mu$ were focused, while in (8) the egg-white was coagulated only where the spectral lines of wave lengths 302$\mu\mu$ and 297$\mu\mu$ were focused. (3) is a photograph of the quartz cell containing lens protein extracted with 0.1% calcium chloride on which the spectrum of the small burner had been focused for thirty hours. By

comparing (3) with (2) and (7) with (8) it may be seen that the same region of the spectrum of the small quartz mercury-vapor burner effective in coagulating the protein of the egg-white is also effective in coagulating the lens protein extracted with 0.1% calcium chloride solution. The same statement may be made regarding the effective region of the large quartz mercury-vapor burner in (7) and (8). (4) is a photograph of the spectrum of the large quartz mercury-vapor burner made through the cornea of the rabbit, (5) made through glass 1*mm* thick, (6) through glass 5*mm* thick. It may be seen from (4) that the cornea transmits wave lengths as short as 297μμ and 302μμ and from (7) that these are the wave lengths of the spectrum of the large quartz mercury-vapor burner most effective in bringing about the coagulation of the protein of the lens. The large quartz mercury-vapor burner was the one used in the experiments described in which cataract was produced in fish living in salt solutions.

Many observers have attributed their failure to produce cataract in living animals to the protective action of the cornea. I think it will be clear from the experiments reported in this paper that their failure was not due to the protective action of the cornea but to the fact that there were not present in the lens of the eyes of the animals exposed sufficient quantities of salts such as those of calcium to combine with the protein of the lens modified by the ultra-violet radiation, to precipitate it.

CONCLUSIONS.

1. Sodium and potassium salts in sufficient concentration act specifically on the nucleus of the lens, producing nuclear opacity, while calcium salts act specifically on the cortex of the lens, producing cortical opacity.

2. The short wave-lengths of the spectrum produce a molecular rearrangement in the protoplasm of the cells of the crystalline lens, so that inorganic salts such as are found to be greatly increased in human cataractous lenses can combine with the protoplasm to precipitate it, and hence produce an opacity. That the change produced in protein by exposure to ultra-violet radiation is molecular in character and not atomic

was shown by the fact that the exposure did not affect the conductivity of the protein.

3. Since ultra-violet radiation produces a molecular rearrangement in the living material of the lens so that weak solutions of inorganic salts can combine with it to form a precipitate, and since sodium salts are specific for the modified protein of the nucleus and calcium salts for that of the cortex, the assumption is made that of the two general types of cataract, nuclear and cortical, sodium salts function in the production of nuclear and calcium salts in the production o cortical cataract.

4. The lens protein is not only rendered more sensitive to the action of certain inorganic salts by exposure to ultra-violet radiation, but is also rendered more sensitive to the action of certain dyes, as is shown by the fact that lens protein exposed to ultra-violet radiation takes certain dyes more readily than the unexposed protein.

5. That ultra-violet radiation kills living cells by coagulating their protein may be seen by direct observation through the microscope during an intense exposure of unicellular organisms such as paramecia.

6. The effective region of the spectrum in changing the living material of the cell or protoplasm lies between 254μμ and 302μμ. The most effective region is around 254μμ for the small quartz mercury burner used, and around 302μμ for the large burner.

7. An opacity of the lens, or cataract, can be produced in fish living in solutions of those salts found to be greatly increased in human cataractous lenses by exposing the eye of the fish to the radiation from a quartz mercury-vapor burner. This cannot be done by exposing the eyes of fish living in tap water, which contains only very small quantities of these salts.

8. Abnormal quantities of the salts of calcium and sodium silicate in the cells of the eyelid and of the cornea increase the effectiveness of ultra-violet radiation in producing trouble in these structures. Abnormal quantities of calcium salts on the skin presumably increase the effectiveness of the short wavelengths in sunlight in producing sunburn.

9. In looking for the cause of cataract it would seem that

at least two factors should be considered, the one a modification of the protein of the lens by ultra-violet radiation, and the other certain inorganic salts by which the modified protein can be precipitated. According to this hypothesis, the prevalence of cataract among people living in the tropics could be accounted for by the increase in the radiant energy factor modifying the lens protein so that an excess of salts, such as silicates in case of people in India, would combine with the protein to precipitate it and produce an opacity of the lens or cataract. The prevalence of cataract among glass blowers is also accounted for by the excess of the radiant energy factor, the assumption being that glass blowers who develop cataract have a more or less disturbed condition of nutrition expressing itself in an increase in sugar in case of diabetics, calcium salts, or some other substance, which can combine with the lens protein made sensitive by the action of the short wave-lengths. The prevalence of cataract among diabetics is accounted for by the increase, not in the radiant energy factor, but in the chemical factor, specifically dextrose, acetone, β-oxybutyric acid, etc.

BIBLIOGRAPHY.

1. Burge. Archives of Ophthalmology, vol. xxxviii., No. 5, p. 447, 1909.
2. Crookes. *Philosophical Transactions, Royal Society of London*, 1914, A–509.
3. Schanz and Stockhausen. v. Graefe's *Archiv f. Ophthal.*, 1910, lxxiii., 553.
4. Dreyer and Hanssen. *Comptes Rendus*, 1907, cxiv., 234.
5. Henri. "Des Bancels et Wurmser," *Études de photochémie biologiques*, Paris.
6. Hertel. "Ueber physiologische Wirkung von Strahlen vershiedener Wellenlange," *Zeitschr. allg. Physiol.*, v., 1 and 95.

SALVARSAN AND OTHER REMEDIES IN OPHTHALMIC PRACTICE.

By FREELAND FERGUS, Glasgow.

POSSIBLY in no region of medical science is it more difficult to estimate results accurately than in the very important domain of therapeutics. There are often so many factors that are quite unascertainable complicating the problem that it is difficult to estimate how far any drug is of use. Every now and again some remedy is loudly vaunted as being nvaluable in certain forms of disease, but after a few years it passes out of notice and is no longer thought suitable for the very conditions for which it was regarded as a specific on its first introduction. That there has been material progress in therapeutic work must be generally admitted, but what real and lasting progress has been made in recent years has been almost entirely on the biological side, and probably we are only at the beginning of still greater advances in the same direction. When a remedy is at one time extolled as being of very special use under certain conditions, and a few years afterwards is rarely if ever mentioned, it suggests that the original introduction of that medicine was made without a thorough and impartial test. Possibly even in some cases it is boomed by manufacturers who have a financial interest in putting it on the market. One or two examples will illustrate our meaning. Some years ago certain organic preparations of silver were supposed to supersede everything else in the treatment of various forms of conjunctivitis. Three of the best known were protargol, argyrol, and collargol. The first was largely brought into notice by a book written by Dr. Darier of Paris and translated for the English public by Mr. Sydney Stephenson.

A more disappointing book we never read. It is absolutely destitute of any scientific information on the subject. It is a piece of mere empiricism and tolerably crude at that. How these remedies came to be popular and sold in the way they were, as germicides with important actions, is a mystery, for if there is one thing certain, it is that their germicidal actions are practically negligible. Many experiments have been made with strong solutions of these drugs. Cultures have been immersed in solutions of them for hours together and then sub-cultures have easily been obtained. It is difficult to believe that anybody can still hold that a few drops of a solution of any of these drugs introduced into the conjunctival sac for a few seconds can have any influence whatsoever on the flora of the conjunctiva. Undoubtedly they give better results than strong solutions of nitrate of silver, such as were at one time frequently used, for the simple reason that these preparations do no harm, which nitrate of silver unquestionably did. Looking back on the results of the treatment of gonorrheal ophthalmia with strong solutions of nitrate of silver, we cannot but think the result was in almost every case detrimental. The conjunctival sac was never sterilized although the protecting epithelium of the conjunctival membrane and sometimes that of the cornea were seriously damaged. The organic preparations already mentioned do no harm, nitrate of silver does, and hence these preparations appeared to the authors whom we have indicated as intrinsically of high value.

It has now been known for a considerable time that these drugs in the treatment of conjunctivitis are inert, and yet patients turn up in large numbers at our dispensaries and in our private clinics who produce letters from their medical advisers to say that they have been using protargol or argyrol for some weeks or months but without effect. Nobody who knows the facts of the case would expect anything else. Many years ago, indeed shortly after commencing the study of ophthalmology, I came to the conclusion that a conjunctivitis was the expression of one of two things, namely, either an uncorrected error of refraction or a microörganic infection. In the former case it is a question of measuring the error of refraction and correcting it accurately. In the latter it

is a matter of removing and not of killing the organism or organisms.

Another instance of a method of treatment which has been largely boomed was Röntgen ray and radium treatment for cancer. I do not suppose there is a single instance on record in which a case of cancer has been cured by these means, any more than there is on record a case of cancer which was cured by the Count Mattei blue or white electricities. It is possible, perhaps, that the employment of these remedies may give some relief in cases of inoperable cancer and may make the sufferer a little more comfortable, but evidence is totally lacking that treatment by radium or treatment by the Röntgen rays has ever cured cancer. Both of these remedies are becoming more and more placed on the shelf for that malady.

A third typical example is the difference between antiseptic and aseptic treatment. In the old days gauze dressings for wounds used to be thoroughly impregnated with carbolic acid. I myself have examined some of the discharges contained on these dressings and found them to be teeming with micro-organic life. Lister's application of Pasteur's great discovery, we venture to think, was the happiest that has ever been made in the science of medicine, but he did not realize that the means which he proposed for the destruction of germ life were not adequate for the purpose. It is no more wonderful that he did not see the whole of the ground which his work opened than that Isaac Newton saw the fallacies in the corpuscular theory of light, yet, as in the case of protargol, the old idea still persists.

We still find ophthalmic text-books figuring an undine and expatiating in the use of that instrument for applying boric solution as an antiseptic. That a special form of instrument should thus be widely advertised may be of use to the persons who have these appliances for sale. From our point of view it is probably the worst contrivance. You cannot kill germs, as far as we know, by anything which you can apply to the conjunctiva without destroying the membrane itself. You may remove the germs and thereby save the situation, but you will require a thoroughly good douche with a fall of at least eighteen inches and not less than a pint at a time to be used, and of all the apparatus for carrying out such a line of treatment

probably the undine is the least useful. When we find an instrument of that sort recommended, we cannot help suspecting that the author who advises it is still under the impression that the ingredients of the lotion are the important thing and not its method of application. With very few exceptions, the only useful element in any lotion is water which, if not to be painful, must be made isotonic with something or other, preferably with sodium chloride. We cannot help thinking that a man who prescribes boric lotion to be used in an undine has done very little observational work in conjunctival bacteriology.

There is, as is well known, the exceptional case of the use of zinc sulphate apparently freeing the conjunctival sac of the Morax parasite. No doubt similar instances of germicidal effects may be discovered, but apart from this, so far as we know, there is no other instance of an ordinary drug causing an infective microörganism to disappear so long as the remedy is applied only in such strengths as will do no harm to the conjunctival membrane. No one can foretell what the future may have in store, but that is pretty much how the matter stands at present.

But a very important question now arises. Of recent years the same country which gave us protargol and argyrol has given us a new remedy for syphilis for which the strongest claims have been made in influential quarters. It is said to be infinitely better than anything that has yet been used. Men specially trained are to be appointed by the State for its administration and no doubt a large section of the British public who are the victims of syphilis will have salvarsan or its substitutes administered to them.

The circumstance that certain practitioners are to be appointed for its administration points clearly to one thing, and that is that its administration is by no means free of danger, and indeed there is a very fair death-roll connected with the use of this drug already. The vital question thus comes to be: Is this treatment so overpoweringly superior to any other that we are justified in running the extra risk? Is salvarsan or neo-salvarsan so immeasurably superior to mercury that we are justified in running a moderate percentage of risk? If it were proved that these new drugs were an infallible remedy for

this terrible disease I would answer that question in the affirmative.

That however is very far from being the case; and in the state of doubt as regards this line of treatment in which I find myself I have ventured to record some cases to which I would, with all respect, call the attention of syphilologists. I am not one myself but have every confidence that those who are working in this particular department will ultimately get at the facts of the case. I see no more syphilis than is usually seen by ophthalmic surgeons in hospital and private practice.

To begin with, I found that salvarsan was a failure in interstitial keratitis. So far as that disease is concerned, mercury has given very much better results than these newer drugs. I believe that my experience is not singular in this respect. Other practitioners have also reported against their use in this particular disease. The explanation of this failure given by the advocates of this new line of treatment is that the cornea is a special tissue and that the drug does not reach it.

Now one thing is certain and it is that although in health there are no blood-vessels in the cornea still it contains a large number of lymphatics. The fluid which these contain is no doubt derived from the blood stream; why then should the drug not find its way into the tissue? I am at a loss to find an answer.

And here perhaps I may be allowed a short although, as it seems to me, an important digression. Recently I read a statement which in my opinion underestimated the gravity of interstitial keratitis. It was to the effect that the prognosis of this disease is favorable and that the cornea clears completely. Now my experience is that although in the main the prognosis is not bad yet I have never seen a cornea which was not to some extent damaged, and that permanently, by this form of keratitis. In some cases the injury may be slight, in others it is severe and materially interferes with vision.

My present purpose, however, is to call attention to five cases in which the organ of vision was involved by syphilitic disease otherwise than by keratitis and in all of which salvarsan or neo-salvarsan had been used. I shall make almost no comments but for the most part will simply record them as they occurred.

The first case is that of an officer who some six years ago consulted me for an acute iritis. He was put on mercury and atropine in the usual manner and the condition began steadily to improve. He had heard of the new treatment of syphilis and was anxious to try it as a permanent cure. I directed him to avail himself of the services of a colleague who is thoroughly authoritative in this line of practice. That gentleman was given a perfectly free hand and gave him what injections he thought proper. Thereafter a Wassermann reaction was taken and he was pronounced to be permanently cured of his disease, and all treatment was stopped. Ten months afterwards he re-appeared in my room, this time complaining of severe pains in his legs. I sent him to the same practitioner, who found that the Wassermann was now positive. He removed to another station and I cannot tell what became of him. I could not discover any definite ataxic symptoms, but at the back of my mind there was the idea that the pains in the legs might be the beginning of locomotor ataxy.

The second case which occurred about the same time is also very important. A patient came complaining of defective vision in the left eye. On examination I found it to be due to a slight optic neuritis. He admitted quite freely that he had syphilis. Like the patient whose case has just been narrated, he also had heard of the new treatment as a perfect and permanent cure of syphilis and was anxious to try it. I at once gave my consent and directed him to the practitioner who had administered the drug to the patient already mentioned. The injections were duly given and after a Wassermann reaction was found to be negative he was pronounced cured. Within six months he returned to see me and I found him suffering from an acute iritis which at once yielded to treatment with mercury. There had been no chance of a re-infection.

The third case is of special importance, for it suggests even more strongly than the first that instead of being beneficial neo-salvarsan had been injurious. The patient was a lad who, many years before the introduction of salvarsan treatment in any of its forms, acquired syphilis. When I saw him he had all the signs and symptoms of well-marked paralysis of the external rectus of the *right* eye. He was at once put upon mercury by the mouth and by inunctions and made a

thoroughly good recovery. A good number of years afterwards he heard of neo-salvarsan as a remedy which would entirely remove syphilis from his system. Naturally he consulted a practitioner who is justly much esteemed in this line of practice and the drug was duly administered to him. Two years afterwards he came to me complaining of complete blindness of the *left* eye. I found advanced optic nerve atrophy in the affected organ. He told me that he had not observed anything wrong with the eye before the administration of the drug, but that shortly thereafter he found the vision affected and that it had become gradually worse till complete blindness supervened. The administration of the drug may have had nothing to do with the onset of the atrophy, but in view of the facts which we know about soamin, which was previously supposed to be a perfect and safe cure for syphilis, the onset of the atrophy could not but raise suspicions.

The fourth case is one in which the patient had no fewer than eight injections. The first four were given in July and August, 1916, and the last in March and April, 1917. In August, 1917, he came to me complaining of diplopia, which I found to be due to complete paralysis of the internal rectus of the right eye. The movements upwards and downwards were also slightly restricted and there was slight dilatation of the right pupil. The visual acuteness of the eye was $\frac{6}{12}$. He had also all the symptoms of spinal sclerosis. It was quite evident that in this case the drug had not so relieved him of the protozoön as to prevent nerves hitherto unattacked becoming affected.

The first, third, and fourth cases help to strengthen the view that salvarsan, containing as it does arsenic, may be specially harmful to nerve tissue.

The fifth and last case also would seem to show that this method of treatment is not of permanent value. The patient received five injections in Sydney about the month of February, 1916. A Wassermann was done and he was pronounced to be perfectly free of the disease. In July of this year he was admitted to the Fourth Scottish General Hospital with an acute choroido-iritis of the left eye, and so authoritative an observer as Professor Muir pronounced the Wassermann to be again positive.

My experience of syphilis is small. One swallow does not

make summer, and five even such striking cases as the above do not entitle one to do more than hold his opinion in reserve, but that I certainly am doing. I would suggest, however, that all cases in which the drug has been used should be registered and followed up for some years. If the drug is more efficacious than mercury and more lasting in its results and does not cause any ulterior damage, then it may be justifiable to run a certain risk, but if not, then it should not be used. I have formed no dogmatic opinion and am prepared to consider carefully any well ascertained facts which may be stated by those who have a large practice amongst the unfortunate victims of this malady.

FIVE YEARS' EXPERIENCE WITH IRIDOTASIS.[1]

By Dr. DAVID HARROWER, Worcester, Mass.

(With two figures in text.)

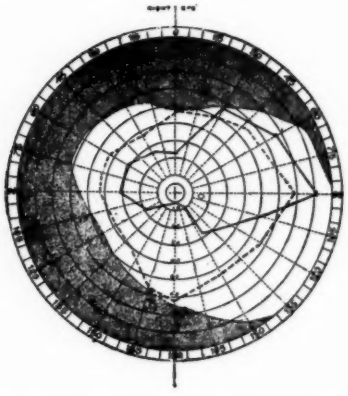
IN 1911 Borthen gave his experience with the operation of iridotasis as devised by him in ninety-seven cases. The results obtained by him were so remarkable that I was led to try the operation in 1911. I reported two cases before this Society in 1912, and several more in 1913. All these cases were done for chronic glaucoma, or for the relief of pain in blind eyes. Of these, two were for the relief of pain, and both were successful. In all I have done twenty-three, so far, with improvement in eyes where there was vision. The field has increased, the tension has diminished, and the patient has been made comfortable at once.

I have so far followed the directions of Borthen as near as possible. I instil a drop of 1% atropin fifteen minutes before I intend to operate. I then follow with a 4% solution of cocaine every few minutes for ten minutes before I begin my operation. For the sake of those who may not have read the method, I will briefly describe it.

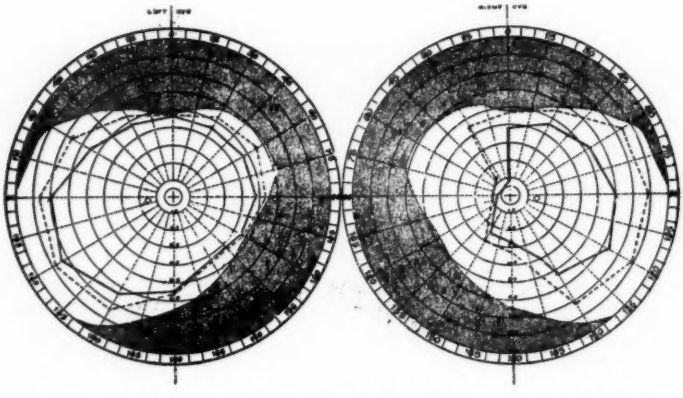
After the cocaine has been used ten minutes, I grasp the conjunctiva about 10*mm* back from the cornea, and make a cut about 10–12*mm* parallel with the corneal line. It is important that the whole subconjunctival tissue should be included right down to the sclera. This whole tissue should be now separated from the sclera down to the sclero-corneal junction, being very careful not to buttonhole, as that would lead to infection. If the conjunctiva is punctured a new field should be used. I use the inverted scissors in dissecting the

[1] Read at meeting of American Ophthalmological Society, 1917.

conjunctiva down to the corneal margin. If the patient is quiet, I simply fix the eye by grasping the free edge of the



CASE 1.—Solid line shows field January 26th; dotted line, field April 4th



CASE 2.—Right eye, solid line shows field, March 23d; dotted line, field May 4th. Left eye, solid line shows field April 17th; dotted line, field May 4th.

conjunctiva with the fixation forceps. Asking the patient to look down, I make the incision just behind the corneal margin about 4*mm* wide. Then with a pair of iris forceps introduced

through the opening just made, I grasp the pupillary margin of the iris, withdraw the iris into the opening in the sclera, smooth back the conjunctiva into place, and the operation is over. If the patient is the least unquiet, I have an assistant fix the eye for me, but so far I have only twice had to use one. I have had no complication, except as in Case 2 and in Case 5 in my report to the Society in 1913, both of which recovered nicely.

I think it very important that the whole conjunctival tissue down to the sclera be included in the operation, as it seems to help the filtration. Borthen lays great stress on the stretching of the iris. He says: "I am convinced that the operation itself supplies a number of important factors which have to do with the structure and position of the iris. Inspection of these eyes after operation shows a very marked variation in the form of the pupil from that produced by iridectomy. It is oval or pyriform with the point toward the incarceration. The radial arrangement of the iris fibers, too, is entirely changed, so that instead of converging toward the central pupil, they are drawn out in the direction of the prolapse. The crypts appear longer, and the contraction furrows are smoothed out. This traction on all parts of the iris diaphragm is marked and may be so excessive as to draw the pupil away from the center. I believe that this traction itself indirectly affects tension much in the same way as, but more actively than, eserin and active accommodation. I am convinced that extraocular filtration is only one, and possibly a minor, factor in the reduction of tension, and the increased drawing through Fontana's spaces in direct consequence of the stretching of the iris plays an important rôle." Personally, I think that the infiltration bleb properly protected with the largest amount of conjunctival tissue is the important part.

Since I made my report of 1913, several reports of cases have appeared. Dr. Dunbar Roy, of Atlanta, Ga., has reported several cases. Dr. Stieren, of Pittsburg, Pa., reported eight cases with good results. Two of my colleagues in Worcester have done this operation. One has done eight cases all with good results; one three cases all with good results.

I have not tried Borthen's recent modification, as his original operation has done so well. I have done twenty-three

operations in all. Every one of them so far has been successful. On May 15th I saw the first two cases that I operated on, and they both had held the vision that they obtained after the operation, and also their fields and tension.

I report the following cases that are typical of all I have so far operated on:

CASE 1.—Mr. A. P., aged 65, March 8, 1916, came to me complaining of severe headaches and failing vision. He had been under treatment for his failing vision for nearly a year. O. D. $\frac{15}{100}$ + 1 D. cyl. ax. 70° = $\frac{15}{60}$, T. 30*mm*. O. S. $\frac{15}{40}$? + 1 D. sph. = $\frac{15}{20}$, T. 57*mm*. The nerve was excavated, especially in the right eye. He was put on 1% pilocarpin.

April 14. O. D. $\frac{15}{60}$ with correcting glass T. 30*mm;* O. S. $\frac{15}{20}$ with correcting glass T. 40*mm*.

Sept. 5. O. D. $\frac{15}{60}$ with correcting glass T. 30*mm;* O. S. $\frac{15}{20}$ with correcting glass T. 40*mm*.

Jan. 26, 1917. O. D. $\frac{15}{10}$ with correcting glass T. 60*mm;* O. S. $\frac{15}{30}$ with correcting glass T. 35*mm*.

Feb. 3. O. D. $\frac{15}{40}$ with correcting glass T. 40*mm;* O. S. $\frac{15}{30}$ with correcting glass T. 30*mm*.

Feb. 5. As the field was contracting in the right eye I did iridotasis.

Feb. 21. O. D. $\frac{15}{40}$ with correcting glass T. 22*mm;* O. S. $\frac{15}{30}$ with correcting glass T. 25*mm*.

May 17. O. D. $\frac{15}{40}$ with correcting glass T. 22*mm;* O. S. $\frac{15}{20}$ with correcting glass T. 25*mm*.

CASE 2.—Mr. J. H. F., aged 61, March 19, 1917, referred to me by Dr. John Cahill. Seen by him Nov. 11, 1916, complaining of failing vision. Vision at that time was with correcting glasses O. D. $\frac{15}{200}$, O. S. $\frac{15}{60}$. Was given pilocarpin, but as no improvement followed was referred to me.

March 23. Field in left eye as shown.

March 26. I did iridotasis on right eye.

April 3. O. D. T. 25*mm*. O. S. T. 25*mm*.

April 17. O. D. $\frac{15}{100}$?, O. S. + .50 D + 1.50 D. cyl. ax. 180° = $\frac{15}{50}$.

April 21. Field of left eye more contracted. T. 34*mm*.

April 23. Did iridotasis on left eye.

May 4. O. D. + .75 D. $\frac{15}{100}$. T. 25*mm*. O. S. + 1.50 D. cyl. 180° = $\frac{15}{50}$. T. 25*mm*.

May 12. Vision in left eye is still $\frac{15}{50}$.

May 18. Vision in left eye is $\frac{15}{70}$. T. 30*mm*. Not a good bleb.

May 21. O. S. vision is $\frac{1}{60}$. Still no good bleb. T. 25*mm*.
May 25. O. S. vision is $\frac{1}{60}$ with glass. Small bleb beginning to show. T. 24*mm*.

CASE 3.—Operated in Boston before the American Surgical Society: "Case 31. No. 4254—Age 67, M. Simple glaucoma, left, tension 7*mm*. Operation Oct. 27th, cocaine. Dr. Harrower. Iridotasis. No complications. Discharged Oct. 31st, improved. End-results: eye white and quiet; tension 10*mm*; filtration scar." A report six months after the operation showed improvement.

LATE INFECTION WITH ENUCLEATION FOLLOWING AN OPERATION OF IRIDOTASIS FOR CHRONIC GLAUCOMA.[1]

By Dr. DUNBAR ROY, Atlanta, Ga.

(With one illustration on Text-Plate IV.)

THE question of late infection following the trephine operation for glaucoma has been quite prominent during the last few years and a number of such cases have been reported by different observers. While the number of operators and the number of such operations have been far in excess of those performed according to the technic of iridotasis, yet up to the present there has been no case reported of late infection following iridotasis, making the present report the first case on record.

This case has already been mentioned by me in the series of nine cases operated upon by the technic of iridotasis and which were reported in the *Ophthalmic Record* for last year.

The history is as follows: Mrs. W. T. R., age 49, consulted the writer on March 7, 1912. According to the patient, she had always had some degree of weakness with her eyes, but about six weeks previous she began to have some dimness of vision, slight pain, and halos around the lights at night. The right eye is especially weak and irritable.

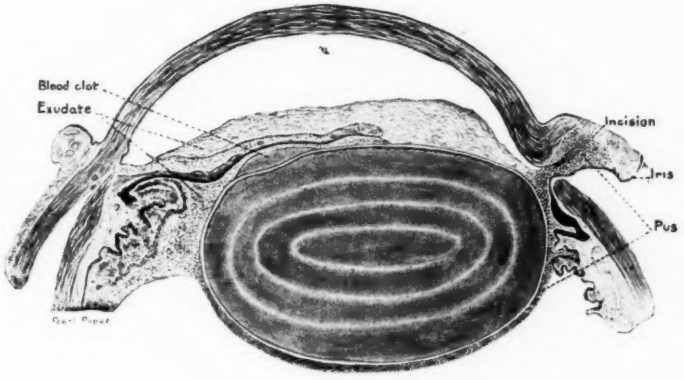
R. Eye Vision = $\frac{20}{100}$ and with myopic correction $\frac{20}{20}$.

L. Eye Vision = $\frac{20}{20}$ and with myopic correction $\frac{20}{20}$.

The right eye showed some increase in the intraocular tension. Pupil slightly dilated, iris bombe. Media clear and no cupping of the disk. Slight congestion and neuralgic pains. The left eye showed normal tension, fundus clear, and no cupping. Correction with glasses were pre-

[1] Read at meeting of the American Ophthalmological Society, 1917.

ILLUSTRATING DR. ROY'S REPORT OF A CASE OF "LATE INFECTION WITH ENUCLEATION FOLLOWING AN OPERATION OF IRIDOTASIS FOR CHRONIC GLAUCOMA."



scribed and a weak solution of eserine ordered to be used three times daily in right eye. Letters from the patient indicated that she was more comfortable and was feeling well satisfied with her condition. On July 1st, same year, patient wrote that her vision in the right eye had become worse and that there was much more pain. On July 7th, she came to the city and the writer operated the same day on the right eye under cocaine anæsthesia by the method of iridotasis. No difficulty was experienced and all symptoms relieved. No suture was made in the conjunctival flap, which the writer now believes was a serious mistake, this being the second case he had operated upon by this method. Since then sutures have been used in every case. The patient returned home on the fifth day and experienced no further trouble.

On July 24th, thirteen days after the operation, patient returned. The iris and conjunctival bleb seemed in good condition and vision had improved to $\frac{20}{70}$ with correction and free from all discomfort. Tension was apparently normal.

The patient did not find it necessary to consult me until one year later. In June, 1913, the left eye was seized with the same acute glaucomatous symptoms as the right, which necessitated an immediate operation. This also was per formed under local anæsthesia and the operation of iridotasis was used. In this case a suture was placed in the conjunctival flap. The healing was uneventful and all symptoms relieved. Vision, two months after operation, with correction was $\frac{20}{30}$.

This patient remained perfectly comfortable and her vision in both eyes with correction was in no wise diminished for a period of almost five years.

On January 15, 1917, almost five years after the original operation, following a severe cold, the patient began to have pain and irritation in the right eye. This continued to grow worse. On January 22d, one week later, she again consulted me. The history showed that the patient had been thoroughly comfortable up to one week ago. There was absolutely no history of traumatism.

Examination.—Patient was suffering considerable pain. The lids upper and lower were swollen and œdematous, giving the patient almost the appearance of an orbital cellulitis. The bulbar conjunctiva was chemotic, the cornea hazy, and considerable protrusion of the iris. Pus was noted in the anterior chamber. The eye showed a typical picture of panophthalmitis.

The left eye was in no way affected and the previous operative results were all that could be desired. Under a general anæsthetic the right eye was immediately removed.

The only accident was the escape of the fluid contents of the eyeball through the original operative incision and the protruding iris. Healing was uneventful. The left eye still remains good. The collapsed eyeball was immediately sant to Dr. F. H. Verhoeff in Boston, who examined the specimen and sent the following report:

"The globe is partly collapsed owing to the large perforation in the sclera near the equator, made evidently during the removal of the eye, and as a consequence, the retina is partly separated. The bleb resulting from the iridotasis is filled with pus and the iris tissue within it is disorganized therapy. The corneo-sclera shows a clean-cut patent opening into the bleb. The lens is not injured and is not incarcerated in the opening. On the opposite side the filtration angle is blocked by the root of the iris. The anterior chamber is filled chiefly with fibrinous coagulum. The pus in the bleb continues through the fistula into a mass of pus which completely fills the vitreous chamber. The ciliary body and retina are giving rise to an abundant exudation of pus cells. The choroid is markedly infiltrated with lymphoid cells, but shows practically no pus cells. The Gram stain shows an abundance of pneumococci in the pus throughout the vitreous chamber. On the ciliary body below there is a small mass of fibrous tissue pervaded by proliferated pigment epithelium, evidently the result of an old localized cyclitis. At the equator, the lamina vitreous of the choroid shows an unusually abundant formation of colloid excrescences. Diagnosis: Iridotasis with late infection with pneumococci. Advanced purulent endophthalmitis."

Remarks: The fact that the case was one of late infection following the operation of iridotasis will in no wise deter me from continuing to use this operation as the one of choice in acute and chronic glaucoma. There were two factors which contribute to this untimely accident and which would have to be considered in any operation for glaucoma.

In the first place, the right eye showed some slow choroidal changes at the original examination, which was also manifested by the myopic refraction. This evidently was progressing and produced a decided thinning of the tunics of the eyeball. Hence the inability of these structures to withstand this increased intraocular pressure and thus giving away at the point of operative incision. This was manifested by the large amount of protruded iris found at the time of enucleation.

In the second place, the failure to replace the conjunctival flap with a retention suture was a mistake, as the protruding iris should be well protected by the conjunctiva. In addition, too large an incision was made at the sclero-corneal margin, with the consequent too large a piece of iris pulled into this wound at the time of original operation. Since then the writer makes a very small incision which allows only a small piece of iris to be pulled up and therefore much more securely anchored in the wound.

TENSION IN NORMAL EYES BEFORE AND AFTER TONSILLECTOMY.[1]

By ANDY M. CARR, A. B., M. D., Chicago,

Staff Resident in Ophthalmology, Cook County Hospital.

(From the service of Dr. E. V. L. Brown.)

THESE observations were made to determine what effect if any, the hemorrhage, anæsthetic, and shock of tonsillectomy have upon normal intraocular tension.

A number of cases of iritis with secondary glaucoma had shown a marked and permanent lowering of tension, along with striking improvement in the iritis, within twenty-four hours after the removal of abscessed tonsils. No tension change had occurred in the fellow eye.

The connection between the infected tonsils and the eye lesion seemed clear, yet it was thought best to make a control study of tension in normal eyes before and after tonsillectomy.

The material comprised one hundred cases of tonsillectomy in patients with no history of eye trouble. None but very controllable patients were used. Their ages ranged from 14 to 67 years. Pus was expressed from the tonsil in practically every case. About two thirds of the cases were operated under local anæsthesia, the remainder with ether. The tension was taken first a few hours before and then twenty-four hours after the operation. The Schiotz tonometer was used throughout and the eyes were anæsthetized with holocain.

From the accompanying table it may be seen that no variation greater than *2mm* was noted in 95% of the cases. This

[1] Read before the Chicago Ophthalmological Society, May 17, 1917. From the Research Laboratory of the Cook County Hospital, Chicago.

amount is of no significance, as all investigators agree that it is in the range of the normal error of observation and is due to the limitations of present-day tonometry. In no case was there a variation of 5*mm* in the readings made respectively before and after the tonsillectomy.

Two cases had secondary hemorrhage with a considerable degree of exsanguination. No difference was noted between local and general anæsthetic cases.

The average tension of the one hundred cases was 17¼*mm;* the lowest tension 10*mm*, the highest 26*mm*.

We therefore feel justified in concluding that tonsillectomy, even when accompanied by considerable hemorrhage, does not have any effect upon normal intraocular tension.

TABLE.

		Before Tonsillectomy.				After Tonsillectomy.					
Case	Age	Tension.		Pupils.		Tension.		Pupils.		Change.	
		Rt	Lt	Rt	Lt	Rt	Lt	Rt	Lt	Rise	Fall
1	19	13¼	15¼	4	4	13¼	16½	4	4	1¼	
2	18	18	15¼	4	4	18	16½	5	4	1¼	
3	17	16¼	16¼	4	4	15	15	4	4		1¼
4	22	14¼	14¼	3	3	15¼	15¼	3	3	1¼	
5	24	18	21	3	3	21	21	3	3	3	
6	17	18	18	3	3	18	18	3	3		
7	27	16½	16½	3	3	18	16½	3	3	1½	
8	19	16½	16½	3	3	15¼	15¼	3	3		1¼
9	20	23	23	3	3	21	21	3	3		2
10	18	18	18	2½	2½	16½	16½	3	3		1½
11	18	19½	18	3½	3½	19½	19½	3	3	1½	
12	28	15¼	15¼	3	3	18	18	4	4	2¾	
13	22	23	23	3½	3½	19½	19½	3	3		3½
14	16	21	21	4	4	19½	19½	4	4		1½
15	20	19½	19½	3	3	18	18	3	3		1½
16	17	18	18	3	3	18	18	3	3		
17	26	18	19½	4	4	19½	18	3	3	1½	1½
18	21	15¼	14¼	7	3	16½	14¼	7	3	1¼	
19	24	16½	15¼	3½	3½	16½	16½	3½	3½	1¼	
20	16	18	18	4½	4½	16½	16½	4	4		1½
21	21	19½	19½	4½	4½	18	18	4	4		1½
22	17	18	18	3½	3½	18	18	3	3		
23	26	18	19½	4	4	19½	18	3	3	1½	1½
24	18	15¼	14¼	3	3	16½	14¼	3	3	1¼	
25	24	16½	15¼	3½	3½	16½	16½	3½	3½	1¼	
26	16	18	18	4	4	16½	16½	4	4		1½
27	17	14¼	16½	3	3	15¼	15¼	3½	3½	1¼	1¼

Case	Age	Before Tonsillectomy.				After Tonsillectomy.					
		Tension.		Pupils.		Tension.		Pupils.		Change.	
		Rt	Lt	Rt	Lt	Rt	Lt	Rt	Lt	Rise	Fall
28	15	21	21	3	3	18	18	3½	3½		3
29	16	15¼	15¼	2½	2½	18	18	3	3	2¾	
30	18	16½	15¼	3	3	15¼	15¼	3	3		1¼
31	23	16½	16½	2½	2½	16½	16½	3	3		
32	21	18	18	3	3	19½	19½	3	3	1½	
33	15	11½	10	8	8	12¼	11¼	8	8	1¼	
34	14	13¼	12¼	8	8	13¼	13¼	8	8		1¼
35	23	18	19½	3	3	16½	18	3	3		1½
36	33	16½	16½	3	3	18	18	3	3	1½	
37	14	19½	19½	3½	3½	18	18	3½	3½		1½
38	14	21	21	3	3	18	18	3	3		3
39	16	10	10	4½	4½	12¼	12¼	3½	3½	1¼	
40	32	19½	19½	3	3	21	21	3	3	1½	
41	23	12¼	12¼	3	3	15¼	15¼	3	3	3	
42	23	18	18	2½	2½	19½	19½	3	3	1½	
43	32	19½	19½	2	2	21	21	2½	2½	1½	
44	17	15¼	15¼	3	3	15¼	15¼	3	3		
45	19	19½	19½	3½	3½	18	18	3	3		1½
46	17	18	16½	2½	2½	18	16½	2½	2½		
47	20	18	18	2	2	21	21	2½	2½	3	
48	19	18	18	3	3	15¼	15¼	3	3		2¼
49	18	18	18	3	3	16½	16½	3	3		1½
50	17	15¼	15¼	2½	2½	15¼	15¼	2½	2½		
51	22	23	23	3	3	21	21	3	3		2
52	20	16½	16½	3	3	15¼	15¼	3	3		1¼
53	20	18	18	3½	3½	16½	16½	3½	3½		1½
54	23	16½	16½	4	4	18	18	3½	3½	1½	
55	23	19½	19½	3	3	19½	19½	4	4		
56	25	16½	16½	3	3	16½	16½	3	3		
57	25	15¼	15¼	3	3	15¼	15¼	3	3		
58	17	18	16½	3	3	16½	15¼	3	3	1¼	
59	22	16½	16½	4	4	18	18	3½	3½	1½	
60	28	16½	18	4	4	18	18	4	4	1½	
61	27	19½	18	3½	3½	18	16½	3	3	1½	
62	19	16½	16½	3	3	18	18	3	3	1½	
63	20	18	18	4	4	16½	18	4	4		1½
64	20	21	23	3	3	18	21	2½	2½	3	3
65	18	15¼	15¼	2½	2½	13¼	14¼	3	3		2
66	18	16½	18	3	3	18	18	3	3	1½	
67	27	21	19½	3½	3½	18	18	3	3		3
68	20	18	18	3	3	18	18	3	3		
69	31	16½	16½	2½	2½	15¼	15¼	2	2		1¼
70	18	18	18	2	2	16½	16½	2	2		1½
71	16	16½	18	2	2	18	18	3	3	1½	
72	33	13¼	13¼	3	3	14¼	14¼	3	3	1	
73	24	16½	16½	2½	2½	15¼	14¼	3	3		2¼
74	26	16½	19½	2½	2½	18	18	3	3	1½	1½
75	29	19½	23	3	3	18	22	3	3		2
76	17	16½	16½	2½	2½	15¼	14¼	3	3		2¼

Case	Age	Before Tonsillectomy.				After Tonsillectomy.					
		Tension.		Pupils.		Tension.		Pupils.		Change.	
		Rt	Lt	Rt	Lt	Rt	Lt	Rt	Lt	Rise	Fall
77	18	19½	18	4	4	15¼	15¼	4½	4½		4¼
78	16	15¼	16½	5	5	15¼	15¼	4	4		1
79	13	18	18	4	4	18	16½	3½	3½		1½
80	20	14¼	21	4	9	13¼	19½	4	9		1½
81	20	19½	19½	5	5	15¼	15¼	4½	4½		4¼
82	25	18	13¼	5	5	13¼	14¼	4	4		4¾
83	16	15¼	15¼	3½	3½	13¼	14¼	3	3	2	2
84	28	19½	19½	4	4	18	18	4½	4½		1½
85	21	22¼	26	4	4	19½	23	3½	3½		3
86	22	21	21	3½	3½	18	19½	3	3		3
87	19	14¼	15¼	4	4	12¼	12¼	3½	3½		3
88	20	16½	16½	4	4	15¼	16½	4	4		1¼
89	24	18	15¼	3	3	15¼	15¼	4½	4½		2¾
90	14	18	18	4	4	19½	18	3½	3½	1¼	
91	14	19½	19½	3½	3½	19½	21	4	4	1½	
92	14	19½	18	3	3	21	21	3½	3½	3	
93	67	16½	16½	3	3	18	18	3	3	1½	
94	17	19½	19½	3	3	15¼	18	3	3		4¼
95	23	16½	18	3	3	18	19½	2½	2½	3	
96	20	11¼	12¼	2½	2½	13¼	13¼	3	3	2	
97	19	15¼	16½	3½	3½	16½	16½	3	3	1¼	
98	17	21	19½	3	3	19½	21	3	3	1½	1½
99	26	14¼	15¼	2½	2½	15¼	15¼	3	3	1¼	
100	22	18	16½	3½	3½	16½	16½	3½	3½		1½

Highest Tension 26*mm*
Lowest Tension 10*mm*
Average Tension 17¼*mm*
Greatest Fall 4¾*mm*
Greatest Rise 3*mm*

ASTEROID HYALITIS.[1]

By Dr. T. B. HOLLOWAY, Philadelphia.

AT odd times one observes in the vitreous certain altearations that are most striking and characteristic, such as the deposition of cholesterin crystals and those snow-white globular opacities that Benson has seen fit to describe under the title of asteroid hyalitis. I am using the same title solely to identify the type of case under discussion and not because I desire to participate in the discussion as to whether the term "hyalitis" is a justifiable one.

Prior to Benson, D'Oench, possibly referring to the same opacities, stated that they presented a picture like that of an astronomic chart, but others have preferred to liken them to snowballs. With others, since observing the first case, I have always referred to them as snowball opacities of the vitreous, not only because of the marked resemblance to actual tiny snowballs, but also because of their similarity to the flower of the *Viburnum opulus sterilis*, the common snowball shrub so frequently seen in our gardens. As to the term "hyalitis," it is probable that the majority of pathologists would take exception to it, despite the opinion of Straub.

The vitreous conditions in the patients observed by me conform quite well to the descriptions given by previous observers. The opacities are globular, many ellipsoid in shape, dull white, and not glittering as is cholesterin. A few may show a slight projecting spur, but all seem to have an appreciable diameter. In the first patient seen by me several white strands were noted. Pollak also observed strands, and he attributed them to the exaggerated elliptical shape of the opacities, that is, they became spindle form; this type,

[1] Read at meeting of American Ophthalmological Society, 1917.

however, must be quite unusual. In certain cases there is but the slightest movement of the opacities on various excursions of the eyes, while in others the movements are quite extensive, but, irrespective of the extent, the opacities do not settle to the bottom of the vitreous chamber but return approximately to their original positions. They may be present in certain portions of the vitreous or the whole structure may be studded with them. In the presence of a lesion of the choroid these opacities, while present, are not necessarily in that portion adjacent to the lesion, as in Case 2, where there was a decided lesion in the lower and outer portion of the fundus, and only the central portion of the vitreous was involved; that is, the portions of the vitreous adjacent to the inner coats were free from these opacities. In the marked cases, when light is reflected into the eye by the ophthalmoscopic mirror, the white dots can be seen at a distance of 6 to 12 inches in front of the eye. When using a +7 or +16 lens in the aperture of the ophthalmoscope, one is apt to think at the first glance that he is dealing with two different types of opacities. Those within focus present the appearance above described while the other opacities appear milky and ill defined, not unlike the flocculent appearance presented by phosphates in the urine.

As to vision, this is apparently not affected in patients with a moderate involvement, and probably only slightly so where the whole vitreous is abundantly filled with these opacities; the reduction in vision, if it exists, is certainly less than one would expect.

While this type of opacity most closely resembles cholesterin, I am convinced that a few minutes' study under proper conditions would promptly lead to the conclusion that they are not cholesterin crystals. This conclusion is based entirely upon clinical observation, for up to the present time, as far as I have been able to determine, none of these eyes has been examined pathologically, nor have any of these patients been subjected to careful and complete physicochemical tests. I do not mean to infer that cholesterin may not be present in certain quantities, but certainly the characteristic appearance of the snowball opacity is not due to cholesterin as we are accustomed to seeing it.

Whether these opacities are formed during some stage of the same process, that is concerned in the production of cholesterin crystals in the vitreous, or as the result of some analogous process, only future clinical and laboratory work can determine. Because these opacities most closely resemble cholesterin, and also because the patients showing these two types of opacities present certain other clinical resemblances, it may be well to briefly refer to synchysis scintillans.

Statistics are rather variable as to the frequency of synchysis scintillans; Webster (1) has recorded 5 among 45,000 cases, while Westpfahl (2), in the most recent tabulation, records 40 among 65,000 cases observed in the Würzburg Clinic. In addition to cholesterin, tyrosin, margarin, and phosphates have been found in these cases. Whether the crystals more frequently present a golden or silvery appearance need not be dwelt upon. It is essentially a condition of advanced years, said to be more common in women, and has been ascribed to diseases of the liver, arthritis, alcoholism, syphilis, and arteriosclerosis; it has also been found in cases of albuminuria and diabetes. Kipp (3) has described 6 cases, in 5 of which there was middle-ear disease. As to the eye, synchysis scintillans has been observed in association with signs of inflammation involving all parts of the uveal tract, affections of the retina, pathologic conditions of the lens, changes in the optic nerve, and glaucoma, and with certain corneal changes. Roemer has referred to its frequency in traumatic cases, 24 out of 50—48 per cent. In the 40 cases referred to by Westpfahl, 19, or 47 per cent., occurred in normal eyes or with unimportant affections of the cornea; the average age being sixty-two. In 10 cases, 25 per cent., there was associated cataract, the average age being seventy years. He believes this frequency accidental rather than causal. In 11 cases, 28 per cent., there were associated intraocular diseases, such as glaucoma, choroiditis, disease of the retina, optic atrophy, and traumatic detachment of the retina. The average age was sixty, although the youngest patient was twenty-five. Here again there appeared to be a causal relationship, but at least in the majority of cases it was not regarded as more than a coincidence.

The literature relating to these snow-like opacities is scanty, and while I have not exhaustively searched the literature of synchysis scintillans and thus probably have missed certain cases, I have found the following on record:

The first was one of four instances of synchysis scintillans referred to by Webster in 1884, and in certain respects I regard it as one of the most important. The patient was a woman seventy-six years of age. V. R. E. = $\frac{3}{100}$; L. E. = $\frac{20}{100}$. Patches of xanthelasma were present about the internal canthus of each eye. The lenses showed incipient opacities. Studding the whole vitreous of the right eye were small, round, white opacities, and between these could be seen a few small glittering crystals.

In 1889 Valk (4), after alluding to an observation made by D'Oench, referred to two patients so affected:

> CASE 1.—Male, aged seventy-three years. Complained of spots before his eyes and gradual failure of vision for five years. There was no history of injury. The vision of each eye was $\frac{20}{40}$, with and without correction.
>
> CASE 2.—Male, adult. Detachment of the retina of the right eye, the result of trauma six months before coming under observation. The left eye had a convergent paralytic squint, the result of a blow fifteen years before. The vision was poor, and the eye was subject to recurrent inflammatory attacks. In the left eye of both of these patients the vitreous exhibited numerous white, glistening spots that appeared to be suspended and did not sink to the lower parts of this structure when the eye was stationary. Excursions of the globe produced slight movements of these white opacities, but some of them seemed to be held in place by minute dark filaments that were lost in the substance of the vitreous. The opacities appeared as round bodies involving all portions of the vitreous; they were intensely white and were surrounded by a dark circle, like an air-bubble under the microscope.

In 1894 Benson (5) referred to a male patient, aged sixty-two years, who had contracted syphilis thirty years before coming under observation. His general health was good, and examination of the heart and kidneys negative. There was no history of gout or rheumatism. The vision of each eye was $\frac{6}{9}$. No changes were noted in the right lens or fundus, but studding the whole vitreous were hundreds of small,

smooth, fixed, cream-colored spheres that in appearance resembled the stars on a clear night. During a period of nine months no change was noted in their appearance.

Argyll-Robertson stated he had observed an exactly similar case except that the bodies were movable and resembled a series of snowballs.

In 1896 Pollak (6) placed on record the data of a similar case observed in the Fuchs clinic. The patient was a female, aged fifty-one years. She had a high hyperopia and gave a history of an attack of acute articular rheumatism at the age of thirty. Both eyes were glaucomatous, the right being blind as the result of this process. In the periphery of the right eye there were areas of atrophy and choroiditic foci. A pigmented strand extended from the lower portion of the retina into the vitreous. In the vitreous of the right eye were numerous round and elliptic white opacities, and some of these were so much elongated that they might be referred to as cords or strands.

In 1909 Wiegmann (7), in discussing certain phases of synchysis scintillans, referred to a male, age fifty-seven years, with arteriosclerosis and profuse retinal hemorrhages of the right eye. The fundus of the left eye was said to be normal. By direct examination with gaslight, dull, snow-white particles could be noted in the vitreous of each eye that gave the impression of falling snow as the eye moved. He believed that calcium salts were probably the principal components of the crystals.

In January, 1917, Stark (8) reported the histories of three patients similarly affected:

> CASE 1.—Male, aged sixty-four years. The optic nerves were rather pale, but there were no changes in the choroid or retina. Perimetric examination revealed a central scotoma for red and green. Albumin and granular casts were found in the urine and the Wassermann test was weakly positive. Vision could be improved to $\frac{20}{30}$. The disk and field changes were first attributed to the kidneys, later to syphilis.
>
> CASE 2.—Alcoholic male, aged sixty years. V. R. E. = counting fingers at 12 feet; L. E. = $\frac{20}{50}$. The right nerve was pale. In this patient the opacities were noted only in the temporal portion of the vitreous of the right eye. The

poor vision of this eye was attributed to amblyopia exanopsia and phlyctenular macula of the cornea.

CASE 3.—Female, Mexican, aged thirty-five years. There were no intraocular changes except the characteristic vitreous change. The urine and Wassermann tests were negative. The corrected vision was $\frac{20}{15}$ in each eye.

In addition to these cases several other references should be mentioned. Thus, D'Oench's (9) patient, referred to by Valk, had a detached retina. "The peculiar feature of this case, however, was found in the presence of numerous small white dots scattered throughout the detached portion, but most numerous near the periphery, apparently of the size of a pinhead or less in the ophthalmoscopic image, and not confluent." They resembled the stars in appearance. These dots Valk supposed to be in the vitreous, although D'Oench's statement is as above quoted.

Hill Griffith (10), in speaking of synchysis scintillans, states that in many of the cases he has seen opacities that appeared as white, glistening, round disks with the surface presented toward the observer. These shifted but little on movements of the globe.

The cases observed by me were as follows:

CASE 1.—Male, aged seventy-four years. This man was a patient of Dr. de Schweinitz's, and was seen by me August 19, 1909, during his absence from the city. The man complained of failing vision. V. R. E. $= \frac{5}{60}$; L. E. $= \frac{5}{50}$. The right lens exhibited incipient opacities. The whole vitreous was studded with an enormous number of small, white globular opacities that moved freely with the movements of the eye, but did not settle to the bottom of the vitreous chamber. Several short white strands could also be seen, and on these were several white opacities, smaller than the average isolated opacity. The disk was healthy. In the periphery of the fundus there was a tendency to vague pigment blotches. The left eye did not show the characteristic vitreous changes, but otherwise was similar to the right eye. The corrected vision was $\frac{5}{15}$ for the right eye and $\frac{5}{12}$ for the left. As this patient lived in one of the western States and was under observation but thirty-six hours, no opportunity was afforded for general examination. He stated that he had had casts in his urine for the past twenty years.

CASE 2.—Male, aged fifty years. First seen September

19, 1912, when he complained of aching pain in his eyes, associated with flashes of light. The examination of the right eye was negative. In the left eye, located in the central part of the vitreous, were a number of these characteristic opacities. Far out in the lower temporal periphery was an isolated patch of retinochoroidal disturbance, the finer vessels near it showing considerable tortuosity and kinking. A few tiny hemorrhages and minute dilatations of the fine twigs could be noted. Between the inferior temporal artery and vein there was an elliptic area studded with tiny thin hemorrhages. V. with correction: R. E. = $\frac{5}{4}$; L. E. = $\frac{5}{4}$ —.

When about twenty he had alopecia areata. He had been troubled more or less with gastro-intestinal disturbances, and two years before had what he described as "ptomaine poisoning," and was quite ill for two and a half months; in fact, he did not fully regain his heath for a year and a half. He has been compelled to avoid fruits and sugars, as they produce a diarrhea. He was requested to see his family physician, Dr. Charles Codman, who reported the lungs, abdomen, and heart to be negative. The urine was likewise negative, except for a few uric-acid crystals. Blood-pressure was 110–80. He was advised to take very small doses of sodium iodid. Later he was put on inunctions. He then passed from my observation until November, 1916, when he returned for refraction. At this time the opacities were certainly more numerous and more movable. No free hemorrhages were noted, but the same tiny aneurysmal or venous dilatation could be noted near the peripheral lesion. V. R. E. = $\frac{5}{6}$; L. E. = $\frac{5}{6}$ —. In February, 1913, he consulted Dr. Codman owing to redness of the tip of the nose. Over the affected area there was distinct capillary dilatation that persisted for some time. Blood-pressure was 135–110. In March, 1917, he again consulted Dr. Codman, complaining of feeling tired and weak, which he attributed to overwork. The urine showed a trace of albumin and also some indican.

Case 3.—Female, aged fifty-five years. First seen by me on Dr. de Schweinitz's service at the University Hospital, April 7, 1913. Fundus examination of the right eye did not show any characteristic vitreous changes. The disk was slightly off color. In the macular region there was a yellowish choroidal lesion and three well-marked hemorrhagic areas of moderate size. Scattered about the posterior pole were a number of punctate yellowish lesions. There was a slight sclerosis of the vessels. Examination of the left eye revealed a number of these characteristic opacities in the vitreous. Small and old choroiditic foci were present be-

tween the disk and macula, and along the superior and inferior temporal vessels. V. R. E. = $\frac{1}{100}$; L. E. = $\frac{6}{6}$, corrected. She was referred to the Medical Dispensary for examination, and the late Dr. Klaer reported that there were no signs of pulmonary tuberculosis and no evidences of specific disease. The symptoms were regarded as due to gastric or digestive disturbances and a very bad condition of her mouth and teeth. A later report stated that there was no nephritis; the blood-pressure was low and the Wassermann test negative. There was a faint trace of albumin in the urine.

CASE 4.—Female, aged seventy-three years. First seen at the University Hospital on March 23, 1917, owing to a slight conjunctival catarrh. Each eye showed a most extensive involvement of the whole vitreous with these characteristic opacities. Many of them showed irregularities or spurs and had a wide range of movement upon rotations of the globe. It was difficult to study the fundi, but certainly no disk changes were present and no lesions of the choroid or retina were noted. Each lens, however, showed incipient opacities. The correction of a high myopic astigmatism gave $_{7.5}^{6}$ vision for each eye. She was examined at the Medical Dispensary by Dr. Thomas Kelly, who reported that there were no demonstrable cardiac lesions and that the urine was negative, as was the functional kidney test. There was an arthritis of some of the smaller joints, and the patient complained of myalgic pains. There were no gastro-intestinal symptoms aside from constipation. The Wassermann test was negative.

Of these 13 patients, 8 were males and 5 females; 11 were over fifty, 4 of these being over seventy; 1 thirty-five, and 1 was an adult, the age not being stated. In 2 instances there was bilateral involvement; in 7 the right eye only was affected, and in 4, the left eye. As to syphilis, 1 acknowledged the disease, 1 had a positive Wassermann, and in 3 this test was negative; all were presumably serum test. The associated ocular conditions have included lenticular opacities, signs of inflammation of the uveal tract, optic atrophy, and glaucoma, and, if D'Oench's patient be included, detachment of the retina.

From the above cases it can be seen that there is a striking clinical resemblance between these cases with snowball opacities and those showing cholesterin crystals. Both occur most frequently in individuals well advanced in years, and in

connection with essentially the same systemic conditions; both have been associated with varied and similar ocular disturbances or have been present without other visible intraocular or fundus conditions. Such being the case, it does not seem irrelevant to make brief further reference to synchysis scintillans. Sgrosso, in discussing this condition, refers to three groups: first, scintillation in the lens in the presence of cataract; second, exclusively in the vitreous, with integrity of the lens; third, involving all or some of the ocular cavities, with evident changes in the uveal tract. The cases of snowball opacities above mentioned would be grouped under the second and third division of this classification.

Concerning the pathogenesis of synchysis scintillans I would refer to Sgrosso's (11) work or to Roemer's contribution in the French Encyclopedia of Ophthalmology, vol. vi., which includes all the most important of Sgrosso's observations. Concerning group 1, above referred to, I would also refer to the contribution of J. Burdon-Cooper (12) on the hydrolysis theory in the pathology of cataract. He believes the tyrosin content of the aqueous acts as an indicator to the opacification of the lens, and also suggests that cholesterin may be but a further stage of the same process that leads to the production of tyrosin. In cataract associated with albuminuria and glycosuria the tyrosin in the lens and aqueous was much increased. Not less than a half-dozen different theories have been advocated to explain certain cases falling in group 2 above referred to. As to group 3, it seems that in these cases some other factor must be required aside from the lesions with which this phenomenon has been associated, otherwise why the infrequency of the condition as compared to the enormous number of cases showing similar fundus changes?

What is the relation of hypercholesterolæmia to the type case immediately under discussion? Diseases of the gall-bladder, arteriosclerosis, nephritis, diabetes, pregnancy, and some phases of certain infectious diseases may all give rise to an increase in the cholesterol content of the blood. Rehfuss, who has devoted much attention to these cases of cholesterolæmia, advises me that he has not seen instances of

vitreous changes such as I have referred to, although he has not carefully examined the vitreous in each instance while using the ophthalmoscope in his routine clinical work. Even so, it is difficult to see how they could be overlooked, even in a most casual examination, if they were present.

In speaking of diabetic lipæmia, von Fürth (13) quotes Klemperer as stating that the condition is really a lipoidæmia, the bulk of the ethereal extracts consisting of cholesterin and lecithin and not of fats. He quotes Magnus-Levy as stating that the fats fail to pass out of the blood-stream either because of some change in the permeability of the walls of the capillaries or from lack of favorable condition in the fats. What these are it is not possible to say. I have not reviewed the literature of retinal lipæmia that usually develops in young subjects and is apt to be a late manifestation, but in the few cases I am aware of no such characteristic changes were observed. As a matter of interest, mention might be made of the presence of xanthelasma in Webster's patient, a condition which has been attributed to cholæmia and regarded by Chauffard and Laroche (14) as resulting from a transitory or permanent hypercholesterolæmia.

Concerning these snow-like opacities, I believe they constitute a manifestation which, like cholesterin, is most frequently seen in advanced years, and that it is not congenital, as has been suggested. That the condition is or may be progressive, is shown by my second patient, who has been under observation about five years. At first the movement is slight, but doubtless becomes more marked as the condition progresses. In Cases 1 and 6 the opacities had the widest range and were abundant. Cases 2 and 3 had few opacities and less movement. While it may be a coincidence, the opacities in these last two cases seemed to be more perfectly formed.

Considering the clinical resemblance of these cases to those showing cholesterin crystals of the character we are accustomed to see, does not Webster's case, where these two types of opacities were seen side by side, still further suggest the belief that the snow-white opacities are formed during the same or similar process that has to do with the deposition of cholesterin in the vitreous?

All observers who have written concerning these opacities have agreed that they are not cholesterin, although I would not be surprised if cholesterin would be found in an analysis of the vitreous of one of these patients. Whether calcium salts enters into their composition, as suggested by Wiegmann, can be proved only by opportunities that so far have not been available, and as to the pathogenesis, this must remain even more obscure than is that of the formation of cholesterin in the vitreous. Concerning Wiegmann's suggestion, it is interesting to note that in a case of synchysis scintillans Königstein (15) found crystals that resembled the oxalate and sulphate of lime obtained by Panas in experimental naphthalin cataract.

Finally, while these cases are not frequently encountered, I believe they are more common than the literature indicates. It is probable that in some instances they have been grouped with the true cases of synchysis scintillans. They should not be confused with the circular or disk-like opacities sometimes seen in severe cases of uveitis and that resemble in appearances the large mutton-fat drops seen on Descemet's membrane. I hope to be able to report further concerning Case 6 and probably Case 3.

REFERENCES.

1. WEBSTER. *Arch. f. Augenheilk.*, 1884, xiv., p. 126; *The Planet*, 1884, i., p. 189.
2. WESTPFAHL. *Inaug. Dissert.*, Würzburg, 1914.
3. KIPP. *Trans. American Otolog. Soc.*, iii., p. v., 112.
4. VALK. *The Medical Record*, 1889, xxxv., p. 569.
5. BENSON. *Trans. Oph. Soc. U. K.*, 1894, xiv., p. 101.
6. POLLAK. *Beiträge zur Augenheilk.*, 1896, xxiv., p. 83.
7. WIEGMANN. *Wochenschr. f. Therap. u. Hyg. d. Auges*, 1909, xii., p. 353.
8. STARK. ARCH. OF OPHTHALMOLOGY, 1917, xlvi., p. 38.
9. D'OENCH. *The Medical Record*, 1889, xxxv., p. 268.
10. GRIFFITH. *Norris and Oliver System.*
11. SGROSSO. *Revue générale d'ophtalmologie*, 1892, xi.
12. J. BURDON-COOPER. *Ophthalmic Review*, 1914, xxxiii., p. 129.
13. VON FÜRTH. *Chemistry of Metabolism.* Translated by Allen J. Smith, pp. 270, 373, 375.
14. CHAUFFARD and LAROCHE. *Semaine méd.*, 1910.
15. KÖNIGSTEIN. *Wien med. Presse*, 1887, xxviii., p. 851.

ILLUSTRATING DR. COHEN'S ARTICLE ON LEUKÆMIC MANIFESTATIONS IN THE EYE: A CLINICAL AND PATHOLOGICAL REPORT

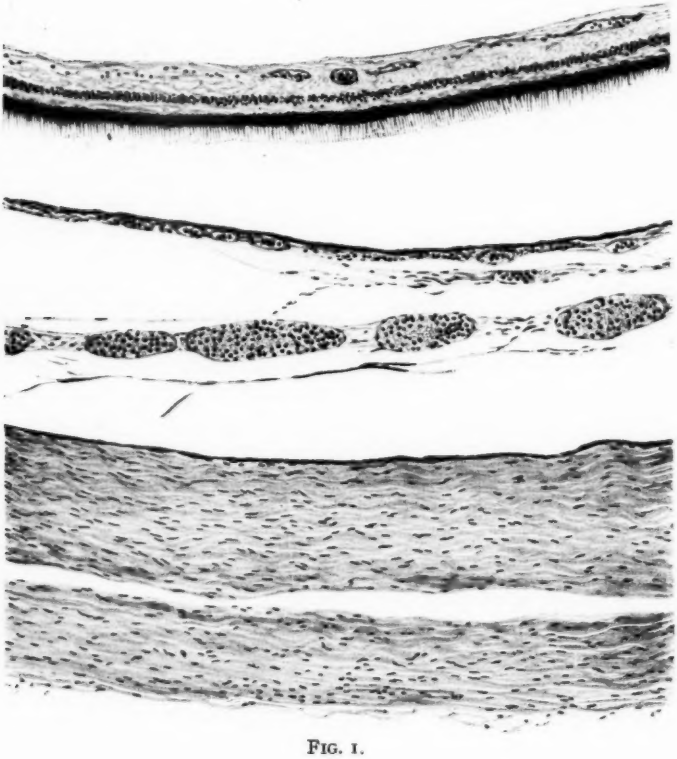


FIG. 1.

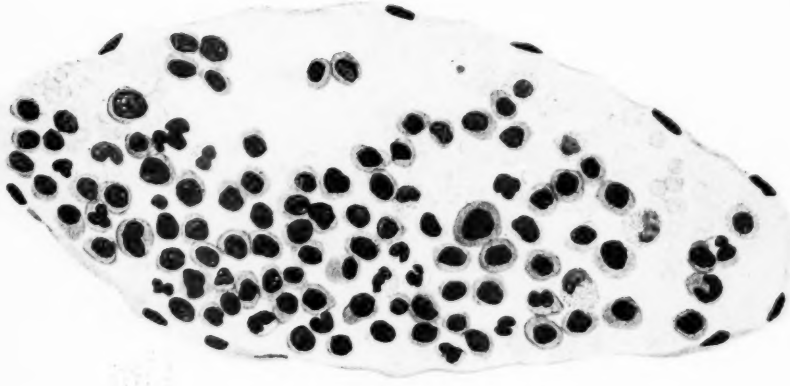


FIG. 2.

LEUKÆMIC MANIFESTATIONS IN THE EYE: A CLINICAL AND PATHOLOGICAL REPORT.[1]

By Dr. MARTIN COHEN, New York.

(With two figures on Text-Plate V.)

Mr. B. H., a laborer 23 years of age, was admitted to the Harlem Hospital suffering from lobar pneumonia. The usual pulmonary signs were present and, in addition, the patient presented clinical findings which were indicative of his blood condition. The liver extended four fingers' breadth below the costal margin, and the spleen to the crest of the ilium. There was no enlargement of the superficial lymph nodes. The blood showed a marked anæmia: the hæmoglobin was 45 per cent., and the red cell count 1,800,000. The leucocytes numbered on two occasions 485,000 and 295,000, and showed the following proportion: Number of cells counted, 400; polynuclears, 43 per cent.; transitionals, 3 per cent.; lymphocytes, 12 per cent.; large mononuclears, 5 per cent.; eosinophiles, 2 per cent.; mast cells, 2 per cent.; myelocytes, 33 per cent. (neurophilic myelocytes, 22, eosinophiles, 7, basophiles, 4). In addition, there were a large number of nucleated red blood cells.

The pneumonia did not resolve and the patient died after twelve days.

The post-mortem report by Dr. Gonzales confirmed the clinical findings. The liver weighed 4.1 kilos, and the spleen 2.3 kilos,—both organs being more than twice the normal weight. Microscopical examination of these organs showed the typical engorgement of blood and lymph spaces with myelocytes, and in places also masses of megakaryocytes; the bone marrow was chocolate color and its markings were indistinguishable. On microscopical examination, masses of myelocytes and megakaryocytes were seen. The

[1] Presented at the January meeting of the Section on Ophthalmology, New York Academy of Medicine. 1917.

clinical and pathological diagnosis was: Chronic Spleno-Myelogenous Leukæmia and Lobar Pneumonia.

The eye examination was last made five days before death, and presented the following appearances:

The palpebral conjunctivæ were extremely pale; otherwise external examination was normal. The acuity of vision, field of vision, intraocular tension, and media were normal. The irides were markedly pale and showed an ectropion of the uveal pigment at the sphincter margin of iris. The pupillary light reaction was sluggish.

The ophthalmoscopic examination was practically the same in both eyes. The fundus color was distinctly lighter than one sees in a normal eye-ground. The disk was of a dirty white color; its margin was completely blurred and was moderately elevated above the surrounding retina. The retinal veins were characteristically tortuous, moderately and uniformly dilated, and of a darkish red color; the retinal arteries were slightly tortuous, of normal caliber, and showed clearly the central light-reflex streak. A circular isolated retinal hemorrhage was seen in the right eye; its size was one-third the diameter of the disk and it was situated two disk diameters to its nasal side. No other pathological changes were present in fundus. *Diagnosis* of fundus condition: Papillo-Retinitis. *Etiology:* Spleno-Myelogenous Leukæmia.

Microscopical Report of the eye: One eye was enucleated ten hours after death, fixed in Müller's fluid, then embedded in paraffine, and finally sectioned. The sections were then stained in a Giemsa solution in order to better study the individual intravascular cellular element of the tissues involved.

The cornea and media are normal. Iris structure is markedly atrophied, showing little stroma tissue; the pigment epithelium is hypertrophied and an ectropion of the pigment is apparent. Schlemm's canal is empty. Lens is normal, but there is seen a deposit of uveal pigment on the anterior capsule at its central area. Ciliary processes are atrophied; ciliary body is normal. The choroid shows characteristic changes, especially posteriorly where the veins are decidedly dilated (see Fig. 1) and filled with numerous leucocytes (neutrophilic myelocytes, eosinophiles, polynuclears), and a few erythrocytes (see Fig. 2). A large hemorrhage is seen in Haller's layer. The marked dilatation of the choroidal veins is probably an early manifestation of choroiditis; a similar venous dilatation exists in other organs of the body. In the retina, the identical intravascular changes are present, but to a less degree, owing to its vascularity, and there is seen a hemorrhage situated in the

nerve-fiber layer of the retina; the macular region is slightly œdematous.

The papilla is moderately swollen, indicating a papillitis. The optic nerve and sheaths are normal; its veins contain similar cellular elements to those found in other structures of the eye.

Microscopical Diagnosis: Neuro-Chorio-Retinitis.

REMARKS.

1. It is apparent from this report that the changes occurring in the eye in spleno-myelogenous leukæmia are analogous to the changes manifest elsewhere in this disease.

2. The pathological condition is concerned mainly with the intravascular elements which characterize this blood state, as has been noted by other authors.

3. The involvement of the choroid and retina points to the existence of a Chorio-Retinitis Leukæmica instead of a Simple Retinitis Leukæmica as generally described.

PENETRATING INJURY LIMITED TO THE EYEBALL FOLLOWED BY ACUTE TETANUS.[1]

By Dr. ROBERT SATTLER, Cincinnati, Ohio.

THE following excerpts have been taken from a complete clinical history of a case of acute tetanus, following a penetrating wound of the eyeball, furnished me by Dr. Shanks, interne of the Ophthalmic Department of the Cincinnati General Hospital.

Ç. H., æt. 21, farmhand; while seated on the rear end of a wagon on which he was riding, his right eye was struck and perforated by a punch shaped arrow of desiccated horseweed which had been aimlessly shot from a crossbow by a boy on the opposite side of the street, a distance of fifteen or more feet.

The implanted foreign body was speedily jerked out of his eye by his own hand and he sought at once the advice of a nearby physician, who removed several smaller pieces of foreign substance, but whether these were fragments of weed or dirt he was unable to state.

At the Cincinnati General Hospital he was examined immediately after admission, or thirteen hours after the injury was received, and it was found that the entrance perforation or wound was strictly limited to the cornea with mangled iris tissue and lens substance protruding. Under local anæsthesia the wound was cleared of all extraneous matter and shreds of iris tissue and lens substance removed. Great prostration and pain, œdema of the eyelids and bulbar conjunctiva, and an opalescent discharge pointed to an imminent vicious reaction. The further statement that the improvised weed arrow had been just pulled out of the ground by the boy who shaped and shot it, induced me to advise and direct immediate enucleation. This was done on the same day by Dr. Ray, assisted by Dr. Shanks.

[1] Read at Meeting of Am. Ophth. Soc., Hot Springs, Va., 1917.

Nothing noteworthy happened until the afternoon of the third day, following the operation, but in the meantime the patient had been up and about, and was apparently in excellent health and spirits and had not complained of pain or discomfort and the cavity appeared clean and free of all irritation and undue secretion. He referred to difficult mastication and stiffness of the muscles of the jaw, more marked on the right side. From further examination and consultation it was evident that trismus was already present. He was given a large dose of antitetanic serum intravenously and removed to the serological department in charge of Dr. O. Berghausen, who from this time on commenced the liberal and systematic administration of antitetanic serum. In spite of large and sustained doses injected intraspinously, 10,000 units once a day, and three hourly ones of 3000 units each, intravenously,—in addition, the orbit was exenterated, under general anæsthesia, and this followed by constant local applications of the serum, and antitetanic serum was injected into and along the sheath of the optic nerve,—the patient died on the seventh day after admission.

The autopsy disclosed: congestion of the lungs, acute dilation of the heart, fatty degeneration of the liver with passive congestion of left lobe, acute splenic tumor, cloudiness of the meninges, and œdema of the brain.

From this brief recital of the principal points it can readily be inferred that we were led to precipitate radical surgery upon the very heels of the injury to avert the dangerous consequences of a next to certain panophthalmitis. We did not lose sight, however, of the fact that the penetrating character of the injury and the more than probable intraocular lodgment of extraneous or even contaminated soil matter included also tetanus among the possible remote complications.

We shared the hope that prompt enucleation of the globe and the very short time interval (24 hours) which elapsed between the happening of the injury and removal of the eye would insure safety against immediate and more remote and only possible dangers. From a cursory review of the literature of modern conclusions of acute tetanus, following injuries of the eye and orbit, it was found that these have been promiscuously grouped under cephalic tetanus. It was impossible for me to determine from the sources accessible to me whether this included a single case in which the injury was strictly limited to the eyeball. The search made, established only that the

larger number were combined ones of the eye and tissues of the orbit or in which missiles or penetrating forces had inflicted other similar wounds to adjacent regions of the face and head. Nor has my own experience furnished me with a similar example of an injury limited to the eyeball, which was followed by acute or chronic tetanus.

The period of incubation of tetanus is necessarily vague in every case. It was unusually short in the present one. It might lead us to assume that owing to the rapid diffusibility of the toxins of the tetanus bacilli, it may have been incredibly short or next to coincident with the injury itself, in this or similar cases. This observation, if confirmed, may in the future direct in every case of this class the early and more liberal use of prophylactic doses of antitetanic serum or long before definite symptoms of trismus are unmistakably present.

Reviewing briefly the probable, or at present accepted bacteriologic facts (1), and the limited clinical ones with case reports of ocular and orbital injuries followed by tetanus which support the former, it would appear that if a destructive pyogenic reaction results, this may prove a possible safeguard against an otherwise certain fatality if, in addition, prophylactic and therapeutic doses of acute antitetanic serum are also promptly and liberally administered.

Brons (2), in a review of infectious lesions of the eyelid and orbit, refers to three cases of tetanus following injuries of the eyelids and orbit. Two were gunshot injuries. In the first reported by Jess (3), the eye was completely dislocated at the time of the accident and was enucleated. Orbital abscess followed with presence of tetanus bacilli, confirmed by culture and their toxins pathogenic to animals. Tetanus did not develop, but vigorous and large doses of antitetanic serum were resorted to.

In Flacher's (4) case trismus or head tetanus followed an orbital abscess, specific organisms were present, cultures positive. Energetic serum treatment in this case also resulted in recovery. A third case reported by Salus (5), penetrating wound and abscess of orbit with implantation of the terminal end of a wooden switch, ended in death, in spite of liberal and systematic serum treatment.

Zurnedden (6) in an exhaustive review of the bacteriology,

etc., of infectious diseases of the eye does not mention tetanus resulting from injury limited to the eyeball.

REFERENCES.

1. JAMES M. ANDERS, M.D., LL.D. Tetanus. *Modern Medicine*, vol. i.
2. C. BRONS. "Infectiöse Erkrankung Lider und Orbita." *Ergebnisse der Allgemeinen Pathologie*, etc. Ergänzungs Band. 16 Jahrgang. S. 237.
3. JESS. *Archiv für Augenheilkunde*, Band 70, S. 42, 1912.
4. FLACHER. *Würtemberg. Med. Korrespond. Bl.*, 52, 1912.
5. SALUS. *Klinisch. Monat. Bl.*, xlvii., S. 116.
6. M. ZURNEDDEN. "Bacteriologie und Parisiten des Auges." *Ergebnisse der Allgemeinen Pathologie.* Ergänzungs Band. 16 Jahrgang. S. 126.

A CASE OF UNILATERAL PROPTOSIS. EXPLORATORY OPERATION. TENTATIVE DIAGNOSIS OF AN ETHMOIDAL OSTEOMA.[1]

By Dr. ROBERT SATTLER, Cincinnati, Ohio.

THE following clinical history refers to a recent case of supposed neoplasm of the orbit in which surgical interference became imperative, for the reason that, to a moderate degree of transitory left-sided proptosis, which had been present for two years but without discomfort or impairment of vision, was suddenly added greater prominence with persistent irritability of the eye, passive congestion of lids and superficial structures, and considerable œdema. Upon his second visit to me, two weeks after the first, vision, which at that time was full normal, had during this short interval dropped to $\frac{20}{70}$, but without adequate changes in the eye ground, other than moderate venous stasis and slight discoloration of the optic papilla.

The disclosures of a most searching exploratory operation conclusively upheld the assertion that a tentative diagnosis of the early stage of an osteoma having its origin in one of the posterior ethmoidal cells or even of the sphenoid, was its only justifiable inference.

This was the more disappointing as the nature and clinical characteristics, their concealed location and inexorably slow growth, and in particular the greater mortality attending surgical interference, of these bony growths, so often of ivory hardness, are all well-known facts of common experience. For these reasons it was decided to await further developments and to add in every way to the comfort of the patient and to prepare the affected region for the best possible subsequent

[1] Read at meeting Am. Ophth. Soc., Hot Springs, Va., 1917.

inspection and observation, and for the present to defer radical surgery. In order to permit readier access to the apex region of the orbit, it was necessary at the time of the exploratory operation to remove the globe as this alone enabled us to examine and confirm with accuracy the protrusion of the still intact inner and upper wall of the cavity. The larger wound of the exploratory operation healed promptly and the traumatism resulting from the more or less rude handling of the tissue owing to the longer time required for the exploratory operation also disappeared rapidly. The patient now wears an artificial eye and there has been no observable change in the deeper regions of the affected orbit.

A former experience with a similar case, the exploratory operation preceded by enucleation of a blind globe, disclosed the presence of a rounded knob of hard consistency about the size of a hazel-nut in the extreme depth of the orbit. It was assumed that the osteoma had started in one of the posterior ethmoidal cells and had forced its way into the orbit. It was subsequently discovered that this rounded mass which was removed at the first operation was the terminal projection of an osteoma which took its attachment from the anterior wall of the frontal sinus and had pushed its ruthless compression directly backwards towards the apex of the orbit. At the age of 27 it had caused absorption of the orbital wall and was far outside its original starting place. At a later date, the frontal sinus was fully exposed and the inner orbital wall ablated and the entire tumor exposed and removed. In the present case a series of carefully prepared X-ray plates since the exploratory operation have been taken by Dr. Lange, but have afforded us no proof of the presence of a more marked shadow of the deeper recesses, supposedly the seat of the tumor.

For these reasons a positive diagnosis is held in abeyance and major surgical interference will be deferred until the needs call for this, either that pain becomes unbearable or other complications arise, or until the tumor through its growing dimensions becomes more accessible to inspection and palpation and more readily amenable to surgical treatment.

The patient was a lad of 14, whose splendid physique and exuberant spirits suggested excellent health in the past

and present and this was fully confirmed by his own and his parents' statements with the exception that for long periods he suffered severe and persistent headaches.

For about two years, members of his family have noticed a slight prominence of his left eye but with no complaint on his part either of impairment of vision, or other discomfort. In the beginning the prominence was transitory. His athletic pursuits were at first held responsible for this, but careful observation disproved it. Suddenly two months prior to his first visit to me, and without assignable cause, overexertion or traumatism, the protrusion of the left eye became more pronounced and permanent.

Present condition: Marked left-sided proptosis, directly forwards and outwards or parallel to the axis of the orbit; unrestricted muscular excursions; objective and ophthalmoscopic examination discloses nothing noteworthy. V = $\frac{20}{20}$; no limitation of visual field for white or colors. Examination of adjacent sinus cavities, frontal, ethmoid, sphenoid, aided by X-ray, transillumination, anterior and posterior rhinoscopy, failed in the discovery of an adequate cause for the displacement of the left eye.

Blood tests, as well as tests for lues and tuberculosis, also furnished no clue.

An exploratory operation was at once advised to determine the location and character of the tumor mass. It was furthermore stated as probable that if the neoplasm was within the funnel of the recti muscles that successful resection of the tumor mass might be accomplished with conservation of the globe.

These suppositions were all disproved by the exploratory operation two weeks later, the patient having suddenly and persistently experienced pain and discomfort with marked irritability of the eye owing to the less perfect protection of the cornea, which already showed slight haziness and irregularities of surface from superficial contusions. Vision was reduced to $\frac{20}{30}$, eye ground normal.

A roomy Kroenlein incision afforded access to and thoroughly exposed the septum orbitale. The fascia was opened close to and parallel to the lower and outer orbital margin. Some fat was removed to permit readier introduction of the finger. The adjacent floor, which region on transillumination showed a somewhat darker shadow, was first explored, followed by a similar thorough palpation of the outer wall. No trace of periorbital thickening or the presence of pathologic alterations could be discovered. The funnel of the muscles was next examined only to find the optic nerve intact and easily traced. This was followed by a deliberate examination of the roof and inner wall with

negative results. The eyelids, which had been provisionally closed, were now released and the globe easily dislocated forwards in order to permit an examination of the extreme apex region of the orbit. After careful search a rounded, extremely hard protrusion of the inner and upper wall was discovered with its convexity outwards and with perceptible contraction of the lumen of the orbit. This was confirmed by Dr. Ray and Dr. R. R. Sattler. We then decided to enucleate the globe in order to permit an easier access to the region, corresponding as best we could judge to the ethmoid or sphenoid bones, and from which the flattened hard button-like projection had pushed the orbital wall out and contracted its lumen. The improved means of access through the combined openings of the exploratory incision and the large opening of the conjunctival sac enabled us to confirm the presence of this rounded bulge of the inner wall and to compare its extreme hardness with the adjacent region forward.

After careful consideration of the gravity of the situation it was determined not to proceed with the removal of the small and probable osteoma, but to seek further information from carefully prepared X-ray examinations and the disclosures of further observations.

The septum orbitale and external wound were securely closed and the conjunctival sac sutured. Recovery was speedy and uneventful.

SARCOMA OF THE CHOROID WITH SECONDARY CHANGES.[1]

By Dr. EDWARD JACKSON, and Dr. WILLIAM C. FINNOFF, Denver, Colo.

THE following case is of especial interest on account of its long duration, the time the eye was retained after it reached the stage of secondary glaucoma, the violent orbital inflammation that led to its removal, and the significant changes revealed by the anatomic study of the globe.

L. L., a ranchman, gave the following history. He had observed the field of vision of the left eye gradually lost, beginning with the upper nasal portion. August 9, 1902, he consulted Dr. Harold Gifford, of Omaha, to whom (and to his associate, Dr. J. M. Patton) I am under obligations for notes of the case. "The vision of the right eye = $\frac{20}{40}$; left = light perception. There was extensive retinal detachment of the left eye above and around the whole periphery below. He gave a history of having been struck in the forehead by a horse's head some time previous. There was no notation of his having any muscular disturbance at that time."

Mr. L. also gave the history of a fall on the back of the head; and suggested that his trouble might have come from "sleeping out and getting chilled." Soon after seeing Dr. Gifford the eye began to turn in, and the deviation gradually increased until it reached the present condition. On March 22, 1910, he was seen by Dr. George L. Strader, of Cheyenne, who kindly informs me that he noted detachment of the retina and complete blindness of the left eye, and gave glasses for the right. After this no apparent change occurred in the eye until about one year ago, when it began to pain him occasionally and to get somewhat red.

January 26, 1915: *Present Condition:* A healthy man,

[1] Read at meeting of Am. Ophth. Soc., 1917.

aged fifty. Right eye, appearance normal, media clear, vessels in good condition, fundus normal. V. with sph. +1 = 1.2.

Pupils circular; right 3*mm*, left 4*mm* in diameter. Both react well to light thrown in the right eye; not at all to light thrown in the left.

Left eye has no light perception. It converges 50 centrads, but moves freely in all directions. The anterior perforating veins are dilated. There is a thin, band-like, subepithelial opacity of the cornea, extending horizontally to 1*mm* from each limbus and 5*mm* wide. There is gray opacity of the lens nucleus with clear cortex. Tension under holocain (Gradle–Schiötz tonometer): Right 9 (28*mm*), left 4 (52 *mm*). Transillumination gives no pupillary glow through the temporal quadrant of the sclera, but it is good in all other directions.

The ophthalmoscope shows gray opacity of the lens nucleus with clear cortex. The pupil, dilated to 6*mm* with euphthalmin and cocain, shows red reflex in the periphery, upward, inward, and downward, but not outward.

January 27th: Under pilocarpin the eye has become entirely comfortable. Enucleation was advised, but not allowed.

February 6th: His eye remained comfortable until, on the third and fourth instant, he was exposed to cold on the range. On the fourth it became painful. The tonometer shows 4 (52*mm*). The eye is still hyperæmic and sensitive to light thrown in the right eye. It presents no point of ciliary tenderness, but there is slight tenderness when the globe is pushed back into the orbit. Pilocarpin contracts the pupil from 4.5*mm* to 2.5*mm*. The patient still declined enucleation, and was not seen again for seventeen months.

July 6, 1916: The eye remained comfortable under the use of pilocarpin until one week ago. Then it got sore and swelled. This followed getting overheated on the trail, and bathing his feet and legs in very cold water. The eye became painful that night. The lids are now greatly swollen, the eye pushed forward, the conjunctiva very œdematous and chemotic, with ecchymoses. The movements of the eye are greatly limited by orbital swelling.

The cornea presents a grayish-yellow ring 1*mm* within the limbus and 1*mm* wide. Within this ring the cornea is dark in color and quite opaque. There is rather free conjunctival discharge, smears from which prove negative.

July 7th: The eye was enucleated under ether. It was found tightly wedged into swollen orbital tissue to which the globe was tightly adherent and much of which was removed with the eyeball, especially the tissue around the optic nerve.

The enucleation was followed by free bleeding. There was little subsequent pain, and recovery was uneventful. On July 12th he left the hospital, ecchymoses and discharge diminishing. On July 14th all dressings were omitted.

He continues in good health and the orbit remains healthy. An artificial eye is worn with comfort.

Macroscopic Examination.—The globe was very hard. The cornea has a yellowish ring near the periphery, and the remainder of the cornea is opaque.

Anteroposterior diameter, *24mm;* the transverse, *24.5mm.* The stump of the optic nerve is *8mm* long. The vitreous chamber is filled with a reddish-brown mass which resembled an old hemorrhage. The anterior chamber is filled with a whitish exudate. The anterior chamber is *2mm* deep. A *2mm* pupil. Anteroposterior diameter of the lens is *5½mm;* transverse, *9mm.*

The globe was fixed in Zenker's fluid and embedded in celloidin. Sections were stained with hematoxylin and eosin, Mallory's connective-tissue stain, Van Gieson's stain, with iodin, and for iron.

Microscopic Examination.—The corneal epithelium varies in thickness. At the limbus it is five or six cells deep; this rapidly thins to a layer made up of one or two cells. In the center and in other areas there is a complete absence of corneal epithelium, and Bowman's membrane constitutes the anterior layer.

Bowman's membrane is finely granular, and is intact throughout. In it are several round and oval areas of degeneration which stain blue where hematoxylin and eosin are used; blue with Mallory's connective-tissue stain; red with Van Gieson's, and brown with iodin. They are more numerous where the epithelial covering of the cornea has been lost.

The substantia propria is infiltrated from the limbus to the center of the cornea with numerous flattened cells which show the various stages of degeneration. The infiltrate occupies the spaces between the corneal lamellæ. Near the limbus the cells infiltrate only the spaces in the posterior half of the substantia; at a point three-fourths of a millimeter from the limbus the infiltrate occupies the whole depth of the substantia. At this place they are more closely packed together in the spaces, occupying the anterior one-half of the corneal substance. The infiltrate occupies the whole depth of the substantia for about *1mm*, and then gradually confines itself to the anterior one-half of the cornea. This gives the section of the corneal infiltrate a triangular appearance, the base being the denser portion and the apex the thinner portion in the center. A ring *1mm* wide,

located about three-fourths of a millimeter from the limbus, corresponds to the very dense infiltration of cells which occupies the whole depth of the substantia. The ring resembles, histologically, the peripheral annular infiltrate which occasionally follows perforating wounds. The cells infiltrating the substantia have wandered so far from their source of nourishment that the majority have undergone degeneration and their identity is entirely lost. The nuclei are completely disintegrated. Only after prolonged search over several sections with the oil-immersion lens a few cells were found which had not been completely degenerated, and can be identified as polymorphonuclear leucocytes and lymphocytes. Blood-vessels have not proliferated into the cornea.

Near the center of the cornea the corneal lamellæ become swollen by œdema. Small areas of degeneration, which are similar in appearance and staining reaction to those found in Bowman's membrane, are seen scattered through the corneal lamellæ. Just under the epithelium, at the limbus corneæ, opposite the termination of Bowman's membrane, is a mass of hyaline degeneration.

Descemet's membrane is intact, and only an occasional corneal endothelial cell can be found on its posterior surface.

The epithelium of the limbus, cornea, and conjunctiva is invaded with numerous polymorphonuclear leucocytes. In the loose stroma of the limbus and the conjunctiva non-pigmented, spindle-shaped sarcoma cells surround the blood-vessels. This tissue is also infiltrated with polymorphonuclear leucocytes and lymphocytes.

In several sections Schlemm's canal is packed with tumor-cells. The meshwork of the iris angle is also filled with these cells, red blood-corpuscles, and polymorphonuclear leucocytes. The spaces which are not filled with cells are compressed by the iris, which has been pushed forward.

There is a pronounced peripheral anterior synechia of the iris to the cornea. The whole filtration angle is blocked, and the iris is adherent to the cornea for about *1mm*.

The anterior chamber is filled with an exudate of fibrin, a few scattered polymorphonuclear leucocytes, and erythrocytes. Small round collections of pus-cells, resembling minute abscesses, are seen in the exudate. Near the iris the exudate has pigment-granules scattered through it.

The pupil is *2mm* in diameter and is not occluded by any inflammatory membrane. The pupillary margin of the iris is covered with a mass of degenerated pigment epithelium and fibrin, which bows forward and results in a very striking ectropium uveæ.

Several of the iris crypts are filled with degenerated leuco-

cytes. The iris vessels are filled with blood, and several of them are surrounded by an infiltrate of leucocytes. The iris stroma is swollen by œdema. There are many pus-cells between the sphincter fibers. The pigment epithelium of the iris has undergone a very marked degeneration. Pigment-granules have wandered from the cells and invaded the posterior and anterior chambers and iris stroma. The cells with their nuclei have lost all their normal characteristics. Resting on the temporal one-third of the posterior surface of the iris is a pigmented mass which contains degenerated pigment epithelial cells, polymorphonuclear leucoctyes, fibrin, and numerous pigment-granules. The protoplasm of the leucocytes in this area is filled with the pigment-granules. There is no synechia of the iris to the lens-capsule.

The epithelium of the ciliary body has undergone a more complete degeneration than that of the iris. The ciliary processes are devoid of epithelium. The blood-vessels are engorged with red cells and leucocytes. The stroma is hazy from œdema. Tumor-cells and leucocytes have invaded this structure and separate the fibers in many places. A cyclitic membrane extends from the ciliary body to the posterior surface of the lens. The exudate has undergone organization in many places. Capillary loops, fibroblasts, and connective-tissue are present. The exudate is invaded with leucocytes and pigment-granules.

There is almost complete degeneration of the retina; only near the optic nerve can a few nerve-fibers be found.

The choroid of the temporal one-half of the globe is one mass of sarcoma-cells. The tumor mass replaced the vitreous in two-thirds of the globe. Near the sclera the tumor-cells are well developed; but, as the middle of the globe is approached, the tumor changes in appearance and becomes a mass of degenerated cells. The cells in the degenerated portion of the tumor have lost their outline and many of their pigment-granules. The blood-vessels of this portion have shared in the degeneration, and hemorrhages have taken place, completely replacing the vitreous in the greater portion of the globe with red cells and fibrin. Occasionally a blood-vessel is found in the degenerated portion of the tumor, which is surrounded by several layers of new-formed healthy sarcoma-cells. In the tumor are many scattered polymorphonuclear leucocytes and lymphocytes. In some areas in the tumor and exudate dense collections of these cells are found. Around the blood-vessels of the sarcomatous choroid, near the sclera, are collections of lymphocytes. In some areas this infiltration is very dense. On the nasal side of the globe the choroid is not so thick, and a few areas resembling normal choroid can be seen. In the choroid

near the nerve there is an area of ossification. In the remainder, between the blood-vessels, are well-developed sarcoma-cells. The lamina vitrea on this side of the globe is intact and has many warts upon it. The pigment epithelium of the choroid has undergone a degeneration which is similar to that of the ciliary body and iris.

The sclera in many places is invaded with degenerated leucocytes similar to those seen in the cornea. The paravascular spaces of the anterior and posterior ciliary vessels and the vena vorticosa are invaded with sarcoma-cells. The cells can be traced from the intraorbital tumor through these spaces to the orbital tissue.

There is a deep glaucomatous cupping of the nerve-head; the cup is three-fourths of a millimeter deep, and is filled with an exudate of fibrin and red blood-corpuscles. The vessel-walls in the optic nerve are thickened and the vessels are surrounded by a dense infiltrate of lymphocytes

The vitreous is detached and pushed forward behind the lens by the tumor and hemorrhage. The lens is cataractous.

The tissue which adhered to the globe during enucleation is invaded with tumor-cells which surround the blood-vessels.

Diagnosis.—Spindle-cell melanosarcoma of the choroid, with metastasis through the globe into the conjunctival and orbital tissue. A mild panophthalmitis with a peripheral annular infiltrate of the cornea without perforation of the globe. A cataractous lens and a secondary glaucoma following a choroidal sarcoma.

The first striking feature in this case is its duration—over fourteen years from the time sight was noticeably impaired, and two and one-half years after glaucomatous symptoms had arisen until the eye was enucleated. It is certain that detachment of the retina had occurred when the eye was first seen by Dr. Gifford. That the detachment was due to the development of the sarcoma is probable. The impairment of vision began in a portion of the visual field corresponding to the situation of the growth and was gradually progressive. The patient's description of how the field was affected was spontaneous, definite, and obtained before the location of the growth had been determined. The history of other possible causes of detachment was such as might be obtained in any case of loss of sight.

That the diagnosis of sarcoma was not made earlier by competent men, like Dr. Gifford and Dr. Strader, does not militate against this view. The evidence upon which a

diagnosis could be based had not then developed. Probably every ophthalmologist of moderate experience has encountered cases of retinal detachment in which choroidal sarcoma was a possible explanation of the symptom; yet in the absence of other evidence pointing in that direction such a theory was dismissed and in most cases rightly disregarded. Even where there was considerably more reason to suspect sarcoma the failure to make the diagnosis could scarcely reflect on the skill of the surgeon.

Lawford has published a case[1] in which the tumor, seen at the temporal side of the macula, did not cause him to suspect its nature until the patient returned more than three months later. In 1868 Morton[2] reported a case in which iridectomy was done for glaucoma, and two weeks later, there being no relief, the eye was enucleated and found to contain a tumor that occupied one-half the posterior chamber. Again, our competent and careful colleague, the late Dr. W. B. Marple,[3] reported a case in which he had done iridectomy for glaucoma, and within five weeks had enucleated the eye, finding a sarcoma 12 by 14*mm*. In this case the growth had already extended beyond the globe, so that he did exenteration of the orbit five weeks later.

Such a protracted course as our case pursued is by no means unknown. Zentmayer[4] has recently reported the case of a man, aged forty-nine years, who two years before had noticed a scotoma. Corresponding to the scotoma was a mound-like, steel-gray, somewhat mottled swelling in the fundus. The patient refused enucleation, and disappeared; seven years after the initial symptom he returned with acute secondary glaucoma. The eye had remained quiet, except for one congestive attack. Enucleation revealed mixed-cell melanosarcoma, 10 by 7.5 *mm*.

Kipp's[5] case was yet more striking. His patient was seen at the age of sixty-four years, with the right retina already detached, but so transparent that two semiglobular vascular

---

[1] *Ophthalmic Review*, xxxiv., p. 97.
[2] *Trans. Amer. Ophth. Soc.*, 1868, p. 39.
[3] *Ibid.*, vol. ii., p. 193.
[4] *Trans. College of Physicians of Philadelphia*, xxxvii., p. 429.
[5] *Trans. Amer. Ophth. Soc.*, ix., p. 332.

masses of dark color could be seen through it. She refused enucleation. Sixteen years later she returned because the left eye was becoming blind. A year after she was first seen the right eye had been violently inflamed for many months, and then it became quiet and shrunken. Again enucleation was refused. Six years later, or twenty-two years after it was first advised, the eye was removed for hemorrhage from a fungoid mass that had begun to protrude about one year before. The growth was a melanosarcoma in which spindle cells prevailed.

The case reported by Nettleship,[1] when first seen, was noticed as having a normal fundus, but sixteen months later presented a spot below the macula, with a center of dull grayish-black with definite edges and a pale-gray zone around it, the whole quite as large as the opaque disk. Two years after that the patch still appeared flat and not decidedly larger. Then the patient was not seen for seventeen years, when Richardson Cross examined the case and found a rounded mass, seen with a sph.+10 D. lens, suggestive of sarcoma. Four years later he came to Mr. J. B. Lawford for secondary glaucoma, and the eye was excised, almost twenty-four years after the spot was first noticed.

How often sarcoma starts in the choroid but never develops sufficiently to attract attention and lead to a diagnosis we have no means of knowing. But it is remarkable that several cases of the kind are to be found in the literature. Ginsberg[2] demonstrated to the Berliner Ophthalmologische Gesellschaft, March, 1911, an unpigmented sarcoma, 0.8 by 0.3*mm*, found in the choroid of a man aged thirty-two dying of nephritis.

At the meeting of this Society in 1911[3] Fuchs demonstrated three such cases, the largest of which was 2.25 by 1 by 0.52*mm* in size, that were discovered, one *post mortem* in the eye of a patient dying of cysticercus of the fourth ventricle, and the others in eyes enucleated, one for glaucoma, the other for corneal suppuration. When we consider the compara-

[1] *Royal Society of Medicine*, vi., Section on Ophthal., p. 1.
[2] *Centralb. f. praktische Augenheilk.*, 1911, p. 106.
[3] *Trans. Amer. Ophth. Soc.*, xii., p. 787.

tively small number of eyes submitted to careful anatomic investigation, the number of three choroidal sarcomata thus discovered by one observer seems strikingly large.

The peculiarity of the present case, which it shares with those of Nettleship and Zentmayer, is its long period of gradual development without any interruption by violent inflammation, followed by shrinking of the eyeball. Most of the prolonged cases give a history of general ocular inflammation followed by shrinking, as in Kipp's case, and there are others, like the case reported by Roy,[1] in which it is probable that the sarcoma has developed in an eye previously diseased.

This matter of the early recognition and study of choroidal sarcoma through the period of development is of great importance, as stated by R. Foster Moore[2]: "It is clearly of the greatest importance not to remove an eye in which the only flaw is an innocent stationary growth which causes no symptom and no defect; on the other hand, it is imperative to remove at the earliest possible moment an eyeball containing a growth which is a menace to the patient's life."

The course of these protracted cases indicates that within the eye influences are exerted which may retard or wholly check the development of such growths. One of these is probably the influence on cell life of intraocular pressure. The effect of abnormally high intraocular pressure is fairly well known through the changes produced in previously normal tissues by glaucoma. It is rather probable that the normal intraocular pressure exerts some such influence unfavorable to the cell life of a new-growth.

However, another factor must be considered. Every invasion of the human organism, or development within it of adverse forces, is met with some sort of effective resistance. What forms this resistance takes in the case of sarcoma we do not know. But some of the pathologic phenomena associated with sarcoma are manifestations of that resistance. In the present case two sets of facts are to be considered from this point of view. When the patient was seen February 26, 1915,

[1] *Trans. American Ophth. Soc.*, xii., p. 188.

[2] *Royal London Ophthalmic Hospital Reports*, xix., p. 424.

the inflammatory reaction present, following exposure to cold, was something more than a mere exacerbation of glaucoma. And, again, when he came to have the eye enucleated, he presented a low-grade panophthalmitis with severe orbital cellulitis. The ring infiltration of the cornea, closely resembling ring abscess, was a striking symptom. The adhesions found during enucleation indicated similar extensions of inflammation from the globe on former occasions.

Such attacks have also been recorded as the most striking feature of other cases of choroidal sarcoma. Veasey[1] records a case in which the eyeball, enucleated in an attack of marked orbital cellulitis, "was found to contain a large lobulated dark growth occupying the greater part of the posterior half of the globe." Myashita[2] reports two cases. In one attention was first attracted to the eye by an attack of "tenonitis." There was floating detachment of the retina that disappeared after scleral puncture. Two years after the first there was a second attack of "tenonitis." Shortly after this, acute glaucoma set in and the eyeball was removed. The sclera was adherent to surrounding tissue, and flat, spindle-cell sarcoma of the choroid was found. In his second case conjunctival ecchymosis set in after vision had been affected for six months. The eye was slightly prominent and its movements were painful. An area of altered choroid was discovered. Six months later the "tenonitis" recurred, and the choroidal patch showed more the appearance of a tumor. The eye was excised, and a spindle-cell sarcoma found in the outer layers of the choroid.

Myashita quite logically associates his cases with the numerous cases of violent inflammation and shrunken globe, and of sympathetic ophthalmia associated with choroidal sarcoma. He lays stress on the harmful products of tissue necrosis as a cause of such inflammation, but it seems possible that the forces in question are operative from the beginning of the growth of the sarcoma. In Myashita's cases the orbital inflammation came early. In our case the most striking thing about the specimen was that it stained so

[1] *Annals of Ophthalmology*, xx., p. 83.
[2] *Klinische Monatsbl. f. Augenheilk.*, March, 1911, p. 288.

badly, not only tumor-cells and exudates, but even the tissues normally present. Some influence had profoundly interfered with the nutrition of every cell in the eyeball. Coats, commenting on Myashita's paper,[1] calls attention to these "cases in which not only the tumor itself, but all other intraocular structures are necrotic." In reporting on a very small sarcoma of the choroid removed by Buller,[2] Adami says, with reference to certain spindle-shaped collections of pigment: "Not having been able to recognize the nucleus of any of these masses, it is not possible for me to state with absolute certainty that these are cells." The determination as to whether degenerative changes such as are here discussed usually set in before the intraocular tension is notably increased would help to throw light upon their causation.

---

[1] *Ophthalm. Review*, xxx., p. 310.
[2] *Trans. Amer. Ophth. Soc.*, vii., p. 378.

REPORT OF A TUMOR OF THE FRONTAL LOBE OF THE BRAIN WITH OCULAR SYMPTOMS. AUTOPSY.[1]

By Dr. ARNOLD KNAPP, New York.

(With two figures in the text and three illustrations on Text-Plates VI.–VII.)

THE following case of tumor of the frontal lobe is of interest on account of the form of visual-field defect and the cystic protrusion of the floor of the third ventricle.

S. H. V., aged thirty-six years, was first seen on September 11, 1916, on account of failing sight and pain about the left eye which had existed for six months. He had had an attack of grip last winter and has been treated for neuritis. The general health has been good, except that he has been rather irritable, with some mental aberrations and attacks of partial unconsciousness. The patient has been an excessive smoker and a moderate user of alcohol. The Wassermann test was 4+.

Examination of the eyes: V. R. E. = 20/50; L. E. = 2/200, excentric. The pupils contract promptly and then immediately dilate again. The optic disks are atrophic, left more than right, with the characteristics of a descending atrophy. The fields show a central scotoma in both eyes, together with peripheric contraction in the left (Fig. 1). Examination of the nose reveals a deflected septum and left posterior ethmoidal and sphenoidal disease.

The septum was straightened, the left posterior nasal cavities curetted, and some polypoid tissue was removed. This was followed by improved breathing, but no change either in vision or in the headache.

The patient was seen again on March 9, 1917, by the courtesy of Dr. C. G. Coakley. He had been treated with mercurial inunctions, potassium iodid, and strychnin. Vision was reduced to R. E., 2/200; L. E., M. h. in lower field.

[1] Read at meeting of Am. Ophth. Soc., Hot Springs, Va., 1917.

Pupils moderately dilated, react to light. Field reduced (Fig. 2). The headache had not abated. Patient apathetic, mentally slow, and there is numbness of the right side of the face.

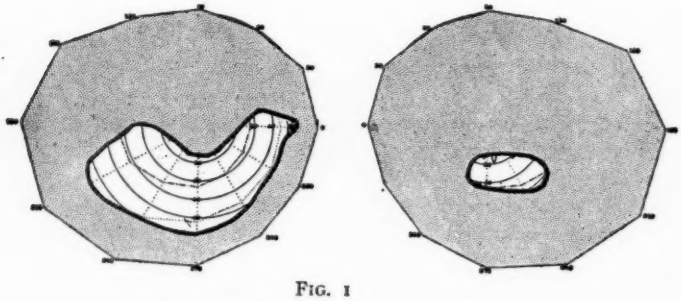


FIG. 1

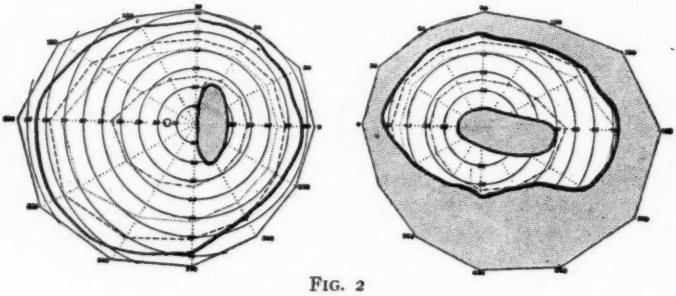


FIG. 2

An X-ray examination was made by Dr. E. W. Caldwell (Fig. 3), who reported that there was external bone absorption in the sella turcica and in the anterior fossa, just anterior to the sella, and above the posterior ethmoidal cells. The cortex of the sella is so completely absorbed that there is no shadow. This absorption suggests pressure by an unusual mass lying in the sellar region, partly in the anterior and partly in the middle fossæ.

He was admitted to the Presbyterian Hospital on Dr. A. V. S. Lambert's service for an exploratory operation. An osteoplastic flap was reflected in the right temporal fossa; general oozing and diploic bleeding were so great that the operation had to be interrupted, and three hours later the patient died.

At autopsy a large tumor measuring 2 by 2½ inches was found in the right frontal lobe. It was an irregular, round

ILLUSTRATING DR. KNAPP'S ARTICLE ON "FRONTAL LOBE TUMOR."

FIG. 3.—X-ray showing excavation and bone rarefaction in ant. and mid. cranial fossæ. Deformation of ant. clinoid processes.

mass springing from the dura on the convexity and from the adjoining part of the falx. The tumor was sharply defined and of a very firm consistence, being readily shelled out, and consequently would have been most operable. The microscopic examination showed it to be an endothelioma. The right frontal lobe was greatly enlarged at the expense of the left, so that the median line ran obliquely in the left half of the skull; the cortex of the right lobe was very much reduced in size, even to the naked eye. The bone covering the sphenoidal and ethmoidal cells was very thin. The optic nerves were distinctly flattened. Posterior to the chiasm there was a rounded, bulging mass, a distended tuber cinereum, which had crowded the optic tracts apart and was hiding the mammillary bodies. The wall of this distended area was so thin as to be translucent. The dilatation of the third ventricle was limited to its lowest part, forming a sacculated diverticulum. The hypophysis was the size of a small lima-bean and was displaced backward. The dural covering to the pituitary fossa was intact, and the infundibular opening was not enlarged.

The brain, in brief, showed a frontal tumor in an enormously enlarged right lobe which had produced a sacculated distention of the third ventricle and pressure atrophy of the underlying bone in the anterior and middle cranial fossæ.

The bilateral central scotoma and the excavation of structures anterior to the anterior clinoid processes, as seen in the X-ray, suggested a definite localization of the tumor at the base of the frontal lobe, but the autopsy showed that the tumor was situated at the convexity of the right frontal lobe, next to the falx.

Tumors situated at the base of the frontal lobe are known to produce optic neuritis, optic atrophy, paralysis of the ocular muscles, and exophthalmos, while pressure farther back upon the chiasm or tract causes hemianopsia. Martin[1] collected 61 cases of tumor of the frontal lobe and found in 31 pronounced optic neuritis, in 10 no change, in 3 unilateral optic neuritis, in 7 optic neuritis occurring late in the course of the disease, and in 10 optic atrophy. In 8 cases the optic neuritis was more marked on the side of the tumor, and in 2 it was more marked on the opposite side. The occurrence of unilateral choked disk in brain tumor confirms the basal localization of the lesion.[2] The combination of one-sided

[1] *Lancet*, July 10, 1897.

[2] Uhthoff: Bowman Lecture, *Trans. Ophth. Soc., U. K.*, 1914.

marked visual disturbance or amaurosis with optic atrophy in association with choked disk on the other side indicates a tumor anterior to the chiasm, which has compressed one optic nerve, causing atrophy and a choked disk of the second eye. The choked disk is prevented on the affected side by the tumor shutting off the communication with the intervaginal space of the optic nerve. Schultz-Zehden[1] reported a case in which a tumor starting from the lower surface of the midbrain had invaded the floor of the frontal lobe and penetrated the right lateral ventricle. The right frontal lobe was enormously enlarged. The right optic nerve in front of the chiasm was completely crushed by the tumor and transformed into tumor tissue. There was an optic atrophy upon that side, with blindness, and the other eye presented the picture of a choked disk. Paton[2] has drawn attention to the fact that a frontal tumor may definitely press upon one optic nerve with a central scotoma in the corresponding eye and primary optic atrophy; in the other eye the sight is unaffected, and ophthalmoscopically there is a fairly intense optic neuritis. Paton states that this class of case, in which there is pressure on one optic nerve with optic neuritis in the other eye, is not uncommon, for during the last few years a number of cases of this kind have come to his attention at the Queen's Square Hospital. Three or four cases were recorded in which blindness developed without disk signs of pressure atrophy, and then atrophy developed in five to six weeks.

In this country Foster Kennedy[3] has described this same association of symptoms of a retrobulbar neuritis on the side of the tumor and papillœdema on the opposite side.

In the case reported in this paper the bilateral central scotoma, to my mind, is an evidence of pressure exerted on both optic nerves. The history of excessive tobacco indulgence and the complicating disease of the left posterior nasal cells cannot explain the optic-nerve changes. That this pressure was considerable is shown by the excavation of the sphenoidal and ethmoidal region, as shown by the X-ray.

---

[1] *Klinische Monatsbl. f. Augenheilk.*, xliii., pt. ii., p. 153.

[2] *Trans. Ophth. Society, U. K.*, p. 133, 1910. *Brain*, 1909, p. 68.

[3] *Amer. Jour. Med. Sci.*, 1911.

ILLUSTRATING DR. KNAPP'S ARTICLE ON "FRONTAL LOBE TUMOR."

FIG. 4

FIG. 5.—Base of brain showing protrusion of floor of III. ventricle.

The cystic distention of the floor of the third ventricle, as seen in this case, is a frequent finding in internal hydrocephalus. Its presence in a tumor of the convexity of the frontal lobe is interesting. The pressure which it exerted was shown by the X-ray to be sufficient to deform the sella, displacing the normal hypophysis backward. It cannot be stated whether pressure enough was exerted on the tracts and chiasm to cause visual changes in this case on account of the severity of the process in the anterior cranial fossa.

It is known that internal hydrocephalus can cause excavation and pressure-atrophy of the sella turcica from cystic dilatation of the floor of the third ventricle. The chiasm which projects into the anterior wall of the third ventricle is compressed and blindness results. Dyspituitary symptoms have also been produced, and supposedly hypophyseal tumors have been operated upon, but the third ventricle was opened instead. As the posterior part of the chiasm projects into the third ventricle, pressure in hydrocephalus may first be exerted upon this part of the chiasm. It is, therefore, possible that the first change in the visual field is a central bitemporal hemianopic scotoma. This can then lead to a central scotoma or to the development of a bitemporal hemianopsia. Bitemporal hemianopsia as a chiasmal lesion from a distended third ventricle is, however, unusual.[1]

---

[1] Henschen: *Berl. klin. Wochenschr.*, 1897, p. 1061. Uhthoff: Bowman Lecture, *Trans. Ophth. Soc., U. K.*, 1914.

REPORT ON THE PROGRESS OF OPHTHALMOLOGY. GERMAN REPORT FOR THE SECOND QUARTER OF 1916.

By H. KOELLNER, Berlin; W. KRAUSS, Marburg; R. KÜMMELL, Erlangen; W. LOEHLEIN, Greifswald; H. MEYER, Brandenburg; W. NICOLAI, Berlin; H. PAGENSTECHER, Strassburg; K. WESSELY, Würzburg; and M. WOLFRUM, Leipsic, with the Assistance of Drs. ALLING, New Haven; CALDERARO, Rome; CAUSÉ, Mayence; CURRAN, Kansas City; DANIS, Brussels; GILBERT, Munich; GRCENHOLM, Helsingfors; v. POPPEN, Petrograd; TREUTLER, Dresden; and VISSER, Amsterdam.

Edited by MATTHIAS LANCKTON FOSTER, M.D., F.A.C.S., New Rochelle, N. Y.

(*Concluded.*)

XI.—LACRIMAL PASSAGES.

41. SALUS, R. **Purulent inflammation of the conjunctiva and lacrimal sac caused by the micrococcus catarrhalis.** *Klinische Monatsblaetter f. Augenheilkunde*, 1916, i., p. 238.

42. V. SZILY, A. **The pathology of the lacrimal passages as shown by roentgenography.** *Ophthal. Gesellschaft in Heidelberg*, July 31 and Aug. 1.

SALUS (41, **Purulent inflammation of the conjunctiva and lacrimal sac caused by the micrococcus catarrhalis**) saw an inflammation in a child a week old which closely resembled at first a very severe gonorrheal infection, with intact corneæ. At the same time there was a marked swelling of the region of the lacrimal sac, pressure upon which caused the expression of masses of yellowish white pus from the puncta. Microscopic examination revealed typical gram-negative cocci, mostly intracellular and lying in nests, of the size of gonococci, but the course under treatment with recovery in four days contraindicated the diagnosis of gonorrheal ophthalmia. The microörganisms were proved by culture to be micrococci catarrhalis.

VON SZILY (42, **Pathology of the lacrimal passages as shown by roentgenography**) has investigated the normal and pathological conditions of the lacrimal passages by means of roentgenographs after previous injection of a suspension of very finely pulverized thorium oxidate in fluid paraffine. These pictures show the normal passages, as well as physiological variations, which may give rise to notable changes. Pathological conditions present many forms, although certain types constantly recur. These principal types are two. In the first group the changes start from the so-called isthmus ductus lacrimalis. A contraction takes place beneath the sac with a comparatively broad duct, which later becomes complete. In another large portion of the cases there is a gradually progressive disease and contraction of the duct from below. In both cases large ectasiæ and diverticuli of the sac may appear as time goes on, of which the roentgenograph first gives us a correct conception. He showed also pictures of tuberculosis of the lacrimal passages, of valvular occlusion in which abundant residual contents always remain after the tensely filled sac has been emptied by pressure, of acromegaly, of congenital atresia of the nasal opening, and of battle wounds of the lacrimal passages. Roentgenography promises to be of special importance in determining the benefit obtained by probing, as well as in aiding in the choice of the various operative procedures. K.

XII.—ORBITS, EXOPHTHALMOS, ACCESSORY SINUSES.

43. AUGSTEIN, H. **Bilateral pulsating exophthalmos caused by a bullet wound.** *Klinische Monatsblaetter f. Augenheilkunde*, 1916, i., p. 484.

44. BIRCH-HIRSCHFELD. **Three cases of optic neuritis in association with empyema of the ethmoid.** *Med. Klin.*, 1916, No. 16, p. 427.

45. CORDS. **The causes of death after wounds of the orbit, and their prevention.** *Ophthal. Gesellschaft in Heidelberg*, July 31 and Aug. 1, 1916.

46. JICKELI, C. **A case of traumatic enophthalmos.** *Klin. Monatsbl. f. Augenheilkunde*, 1916, i., p. 247.

47. JICKELI, C. **Two cases of acute inflammatory exophthalmos.** *Wissensch. Vortragsabend der Militaeraerzte zu Nagyszeben*, Feb. 5, 1916.

The disease in JICKELI'S (47, **Acute inflammatory exophthalmos**) set in with symptoms resembling those of influenza. The exophthalmos amounted to 4*mm* and was accompanied by diplopia. The accessory sinuses and the conditions shown

by the X-rays were normal. All symptoms disappeared in a week under conservative treatment. Apparently these were cases of influenza metastasis.

K.

JICKELI'S (46, **Traumatic enophthalmos**) patient, eighteen years old, was struck on the left temple and brow by a brick which had fallen a distance of two meters. Some days later he noticed that his left eye had become smaller and that he saw double, although the eyeball was uninjured and its vision perfect. Examination of the accessory sinuses and with the X-rays revealed nothing wrong. Consequently the immediate onset of enophthalmos and diplopia, as well as the larger left pupil, the lessened power of accommodation, the narrowing of the palpebral fissure, the continued contraction of the pupil in the dark, and the reduction of the corneal and conjunctival reflexes, could be explained only through a change in the suspension apparatus of the globe. The writer thinks that the shock to the orbit caused a sudden stretching, pulling, and partial laceration of the fascia, which enabled the muscles to retract the globe so that each of its movements resulted in disparate retinal images. The dilatation of the left pupil and the weakness of the accommodation indicate a reduction in the tone of the twigs of the left oculomotor nerve within the orbit. The narrowing of the palpebral fissure and the faulty dilatation of the pupil in the dark point to a lesion of the sympathetic, and the reduction of the corneal reflex to an injury of the sensory fibres of the trigeminus. The simplest explanation of all these disturbances seems to be that a moderately large intraorbital hemorrhage took place in the region of the ciliary ganglion, near which the oculomotor and nasociliary nerves pass.

CORDS (45, **Causes of death after wounds of the orbit**) divides his fifty-eight cases into those in which an inflammation of the orbital tissue itself proved fatal, and those in which the wound of an organ more or less near the orbit caused death. The first group is very small. In spite of severity of the wound infection anteriorly, inflammation of the retrobulbar tissue is very rare, and only one case was observed

in which it caused death, a case of bullet wound through the nose and orbit. The treatment consisted of removal of large foreign bodies from the orbit with only careful attempts to extract small ones, drainage, and the greatest possible quiet of the orbital tissues, especially after symptoms of inflammation appeared. Cords observed no tetanus, or gas cellulitis, after wounds of the orbit. Erysipelas occurred only in one case, which did not prove fatal. In the second group he speaks first of infections of the temporal region and pterygomaxillary fossa, and of infections extending out from wounds of the nose and ethmoid, which often lead quickly to thrombosis of the cavernous sinus and later cause empyemata of the accessory sinuses. Of special importance is the frontal sinus, the posterior wall of which is often crushed. He recommends that at the first operative intervention these cavities should be opened freely and given good drainage, or radically extirpated. He considers fissures in the posterior wall of the frontal sinus to be particularly dangerous, and when these are present lays a larger extent of the dura bare. Wound of a large vessel is a rare cause of death; when the carotid artery or the jugular vein is torn at their entrance into the skull, death follows immediately either from hemorrhage or air embolism. He lost one patient from hemorrhage from the internal maxillary artery. Contusion of the brain may cause death, but a direct wound is more to be feared. Tangent shots of the temporal portion of the brain are not rare and may easily be overlooked, as the wound of the brain is apt to be hidden beneath the temporal muscle. Vertical or horizontal tangent wounds of the frontal portion of the brain require the wound to be laid freely bare by a curved incision through the brows or nose, evacuation of the crushed frontal sinus, very careful attention to the wound in the brain, and open treatment. The prognosis of brain wounds through the orbit is very bad. The cause of death in most cases is encephalitis, the next most common is meningitis, and finally abscess of the brain may cause death suddenly, in many cases after the lapse of months.

K.

AUGSTEIN (43, **Bilateral pulsating exophthalmos**) describes a case of this nature caused by a wound in which the muscles

of mastication and the sternomastoid of the left side were completely torn to pieces, the ramus of the lower jaw, the malar bone and the joint destroyed, and the facial nerve completely paralyzed. Later a distinct pulsation of the carotid could be felt in the posterior part of the scar, the principal veins of the upper lids were distended and tortuous, and both eyes protruded, the right *23mm*, the left *20mm*. No material difference in the exophthalmos when the patient was stooping, or when lying on his back. The intraocular tension was raised. A distinct pulsation, synchronous with the beat of the heart, was felt by the hand placed on the closed lids. Over the entire skull a vesicular murmur could be heard, synchronous with the carotid pulse. Both pulsation and murmur were immediately suppressed by compression of the left carotid. As the patient bore this compression very well, except for a moderate degree of dizziness, the common carotid was ligated, after which both exophthalmos and pulsation subsided. Subsequently fine pigment anomalies appeared in the retinæ of both eyes, together with whitish lines of opacity and punctate hemorrhages in the left, although the vision remained normal in both eyes. The exophthalmos may have been caused by rupture in the sinus cavernosus due to explosive action far above the track of the missile, or to the shock of the contusion of the skull.

BIRCH-HIRSCHFELD (44, **Optic neuritis with ethmoiditis**) obtained good results in three cases of optic neuritis through treatment directed to an empyema of the ethmoid. In testing the vision he recommends to add to the methods usually employed the measurement of the blind spot, which is possible only in very intelligent patients. A transient impairment of vision in the third case he demonstrated to be due to an enlargement of the blind spot.

XIII.—CONJUNCTIVA.

48. BOTTERI. **Vernal catarrh.** *Wiener klin. Wochenschr.*, 1916, No. 15, p. 457.

49. HAAS. **Treatment of gonorrheal conjunctivitis of adults with noviform.** *Wochenschr. f. Ther. u. Hygiene d. Auges*, 1916, No. 29, p. 141.

50. MOHR, M. **Conjunctivitis caused by typhoid bacilli.** *Klinische Monatsblaetter f. Augenheilkunde*, 1916, i., p. 523.

51. PASCHEFF. **A new conjunctival inflammation—conjunctivitis necroticans infectiosa.** *Opthalm. Gesellsch. in Heidelberg*, July 31 and Aug. 1.

52. POLLNOW. **Rare proliferations of vernal catarrh.** *Deutsche med. Wochenschrift*, 1916, No. 18, p. 557.

53. ROENNE, HENNING. **Treatment of chronic conjunctivitis with optochin.** *Klin. Monatsbl. f. Augenheilkunde*, 1916, i., p. 301.

54. SALZMANN, M. **Trachoma and gonorrhea.** *Arch. f. Dermatologie und Syphilis*, CXX., 1.

55. STARGARDT, K. **Ætiology of phlyctenular ophthalmia.** *Ophthal. Gesellschaft in Heidelberg*, July 31 and August 1, 1916.

In cases of chronic conjunctivitis which refused to respond to zinc, silver, and argyrol, ROENNE (53, **Treatment of chronic conjunctivitis with optochin**) obtained a good subjective effect from the instillation of a ½ to ¼% solution of optochin two or three times a day. He thinks the effect of this remedy, like that of astringents, depends on a biological reaction of the mucous membrane rather than on a direct action on the bacteria.

MOHR (50, **Conjunctivitis caused by typhoid bacilli**) reports a case of this nature caused by the accidental inoculation of an eye. In order not to injure the conjunctival epithelium and permit the deeper entrance of the bacilli, energetic treatment was avoided. The conjunctival sac was irrigated with water and applications made of lukewarm boric-acid solution. The conjunctivitis was mild and quickly passed away. Typhoid bacilli were found in the catarrhal secretion on the second day, but had disappeared at the end of six days.

According to STARGARDT (55, **Ætiology of phyctenular ophthalmia**), the old eczematous theory must be thrown aside, because it agrees with neither the histopathological facts nor clinical observations. Phylctenular eye disease is connected only with scrofulosis. As the clinical picture of scrofulosis is composed of two clinical pictures, those of tuberculosis and of the exudative diathesis, it must first be determined to which of these two it belongs. It cannot appertain to the exudative diathesis because phylctenulæ occur in animals also, so it must be connected with tuberculosis. Such a connection is indicated also by experiences with tuberculin, especially the local reaction after subcutaneous injections. Schumacher and Stargardt obtained positive local reactions in 43%. The

idea that phlyctenulæ are of tuberculo-toxic orgin is erroneous. Stargardt's experiments go to show that phlyctenulæ can be formed only when bacilli, or parts of bacilli, are present in the tissue. He likens phlyctenular disease to lichen scrophulosum, and so to cutaneous tuberculide. That this lichen is a true tuberculosis can now be accepted as certain because of positive findings of bacilli and positive results of inoculation, though only in small numbers. As regards phlyctenulæ, only one positive result of inoculation has been obtained, that of L. Mueller, and Stargardt has been the first to find a single case of Much's granular form of tubercle bacillus. The bacillary theory is supported by the findings of Schieck, who repeatedly saw phlyctenulæ in rabbits after the injection of tubercle bacilli into the carotid. A precondition for the development of phlyctenulæ, as for cutaneous tuberculide, is a certain content of antibodies, in consequence of which the bacilli are quickly destroyed, and then, from their remains, phlyctenulæ are formed in the conjunctiva and cornea, lichen nodules and other tuberculides in the skin. The onsets of lichen and other skin tuberculides, and of phlyctenular processes in the eye after acute exanthemata, correspond; in both, according to von Pirquet, the reduction of the content of antibodies plays an important part. The fact that all of the bacilli are not always destroyed gives rise to progressive diseases and to the various pictures that characterize phlyctenular conjunctivitis and keratitis. The frequent localization at the margin of the cornea Stargardt explains through the bad and irregular circulation demonstrated by him in the marginal vascular network. The disease may be of exogenous, as well as of endogenous origin, as indicated experimentally. He believes phlyctenular disease to be a true tuberculosis induced by bacilli in the diseased foci themselves, but very distinct conditions of immunity need to be present, as they occur in benign, not in malignant tuberculosis.

K.

POLLNOW'S (52 **Rare proliferations in vernal catarrh**) nineteen-years-old patient had suffered since his fourteenth year from eye trouble, which set in in the spring and disappeared with the beginning of cold weather. This trouble became

worse in the field. There were commencing proliferations on the conjunctiva of the right upper lid, while on that of the left were very extensive, cauliflowerlike, polypoid excrescences; both the proliferations and the conjunctiva had a dull bluish color. Excrescences at the limbus were wanting in both eyes. No material improvement was obtained by any kind of treatment, including ablation of parts of the growths. He hopes for better success from radical extirpation of the excrescences followed by a pressure bandage retained in position for a long time.

BOTTERI (48, **Vernal catarrh**) has treated fifty cases of vernal catarrh, four of which were complicated by a congestive catarrh which sometimes completely overshadowed the symptoms of the former disease until after its subsidence. This combination of congestive with vernal catarrh may be explained in various ways: (1) The congestive catarrh may be an initial form of the vernal; (2) the cases may have been examples of mixed infection in which there was a simultaneous onset of the two inflammations; (3) the vernal catarrh may have existed for a long time without causing trouble, and the congestive catarrh have been added later. He mentions one case of familial vernal catarrh; two brothers had suffered from this disease since their fourteenth and seventeenth years respectively, and the only son of one of them had suffered from it yearly since his first year.

Between December, 1914, and August, 1915, PASCHEFF (51, **Conjunctivitis necroticans infectiosa**) observed and examined three cases which resembled each other so closely that he believes them to belong to a unique disease not hitherto described. The commencing symptoms are both general and local. The disease sets in with weakness, chill, loss of appetite, frequently headache, and almost always a rise of temperature, which may reach 38.7°, associated with a simultaneous swelling of the preauricular and submaxillary lymphatic glands on the side of the affected eye. Locally there are itching and redness of the conjunctiva, slight swelling of the skin near the ciliary margin, the eyes are opened with difficulty, and there is a little photophobia. The secretion is moderate and threadlike. The conjunctiva of the tarsus and transitional folds is reddened,

greatly infiltrated, and fairly smooth. Soon numerous scattered whitish, dull points and spots form in the inflamed conjunctiva, chiefly in the transitional folds and on the tarsi, varying in size from millet seeds to peppercorns. They vary in form, round or oval, and have irregular, indistinct margins. They appear to be superficial and in many cases occupy symmetrical places in the transitional folds from simple contact. After the elimination of the whitish centers there remain slight deep ulcerations of the conjunctiva which soon disppear and leave no trace. The course of the disease on the conjunctiva lasts from two to three weeks and embraces three periods: (1) The period of necrosis, or formation of the whitish spots; (2) the period of ulceration, or cleansing of the necrotic foci; (3) the period of healing. Only one eye was affected in each of the three cases. The adenitis which accompanies the conjunctivitis lasts longer. Commonly it is confined to the preauricular gland, but may affect the submaxillary, the parotid, and spread to the surrounding tissue. The skin is swollen, glistening, and hot. The suppurating glands were removed in these cases, but the bacteriological and experimental examination of them and of their contents gave negative results. Histologically they presented a thickened capsule with numerous granulations. Experimental studies to determine the cause of this disease revealed its great virulence, and the possibility for the reproduction of the whitish spots in the internal organs, especially the spleen. A microörganism with peculiar morphological and biological properties was isolated. Guinea-pigs inoculated with it die in seven or eight days with the same pathological changes, chiefly in the spleen. The microorganism appears like the coccus and bacillus, attains in culture the size of 0.25 to 3*mm*, is gram-negative, polymorphous, without cilia and capsule; does not grow in the temperature of the laboratory; does not fluidify Loeffler's serum as it does gelatine; forms no pellicle; clouds bouillon; forms no açid; coagulates milk; gives an acid reaction; has no color in agar; gives a weak fluorescence; does not form indol; produces gas; dies in seven or eight days; its virulence diminishes with time. In agar culture for four or five days it becomes threadlike. It is found everywhere, in the secretions, in the sections, and in culture. These facts favor the hypothesis that this mirco-

coccus is the pathogenic agent. Macroscopically the disease is characterized by whitish spots on the human conjunctiva and in the spleen of inoculated animals. Histologically the nodular granulations consist of a proliferation of fixed cells with mitoses, leucocytes, and a wall at the periphery with lymphocytes. Commonly there is a central necrosis, occasionally suppuration in the conjunctiva, almost always in the glands, but no giant cells. The epithelium over the nodules in the conjunctiva is broken through so that the contents may be emptied. In the spleen there are likewise focal proliferations of tissue with a tendency to breaking down and necrosis of their centers, but here also with no giant cells. These changes have hitherto been unknown in human pathology. Prognosis: The spots on the conjunctiva disappear in two or three weeks and leave no traces. The swelling of the glands lasts for months and ends in suppuration. Treatment: Disinfection of the conjunctiva with the usual means. Operation on the swollen glands when they suppurate.

K.

Concerning the relations between trachoma and gonorrhea, SALZMANN (54, **Trachoma and gonorrhea**) says that no uniformity of opinion has yet been reached concerning inclusion corpuscles. It is not yet positively determined what importance these conditions have in trachoma and inclusion blennorrhea, and it is still a question whether these two diseases are related or not. The simultaneous occurrence of inclusions and gonococci is too rare to make a connection between the two probable. The clinical courses and the spread of the two diseases differ. An infection with gonorrhea from a perfectly pure inclusion blennorrhea has not yet been observed. The involution forms of the gonococcus show certain resemblances to elements of the inclusion corpuscles, but this is also true of other gram-negative cocci. The virus of trachoma and of inclusion blennorrhea is filterable, that of gonococci is not. While the former are transmissible to monkeys, no one has yet succeeded in an inoculation with young or old gonococci. The inoculation experiment of Herzog on man is not conclusive, because it is not certain that the culture was pure.

Consequently trachoma and gonorrhea cannot be said to be identified.

K.

HAAS (49, **Treatment of gonorrheal conjunctivitis of adults with noviform**) describes a case of acute gonorrheal conjunctivitis in a man twenty-seven years old, in which the cornea was intact, but the œdema of the lids, the chemosis, and secretion of pus were great. Great quantities of gonococci were demonstrated microscopically. The patient came on the third day of the disease and was treated for four days with irrigations of oxycyanide solution and instillations of choleval three times a day. The disease did not advance, but no improvement appeared. On the seventh day of the disease daily applications of a 10% ointment of noviform were begun, which acted so energetically that no trace of the inflammation remained at the end of a week. This brilliant result the writer ascribes wholly to the noviform.

XIV.—CORNEA AND SCLERA

56. AUGSTEIN, C. **Specific chemotherapy of ulcus serpens.** *Muenchener medizinische Wochenschrift*, 1916, No. 15, p. 530.

57. AXENFELD. **Bilateral primary progressive parenchymatous calcification of the cornea (dystrophia calcarea).** *Ophthalm. Gesellschaft in Heidelberg*, July 31 and August 1, 1916.

58. ERGLETT. **Correction of keratoconus.** *Muenchener medizinische Wochenschrift*, 1916, No. 17, p. 609.

59. FUCHS, E. **Secondary scleritis and episcleritis.** *Ophthalm. Gesellschaft in Heidelberg*, July 31 and August 1, 1916.

60. OESTERREICHER, L. **A case of implantation cyst after** Kuhnt's **conjunctival keratoplastic.** *Klin. Monatsbl. f. Augenheilkunde*, 1916, i., p. 157.

61. UHTHOFF, W. **Further clinical and anatomical contributions to keratoconus.** *Ibid.* p. 385.

62. VON WEHDE. **Optochin treatment of ulcus corneæ serpens.** *Diss.*, Rostock, 1916.

UHTHOFF (61, **Keratoconus**) reports two cases in which he was able to examine eyes with keratoconus after enucleation. In the first case the corneal lamellæ became gradually thinner from the periphery towards the center, in the other the cornea, which had a fairly even thickness, had an ectasia in the center

in which the thinness appeared suddenly. In both patients the other eye had a distinct keratoconus with a gradually increasing ectasia and thinning of the substance of the cornea. In the region of the keratoconus Bowman's membrane was in great part absent. Descemet's membrane showed a defect in both cases, which was thought to be secondary to the ectasia, rather than a primary cause of the latter. The changes in the stroma in the central ectasia were, in the first case, an extensive homogeneous hyaline degeneration and a destruction of the corneal corpuscles; in the second case, the central thinning was very considerably due to atrophy and loosening of the corneal tissue, with fissures parallel to the surface, and a slighter degree of homogeneous hyaline degeneration. No brownish ring could be found in the deep layer of epithelium. Both patients had slight tachycardia, one a slight leucocytosis, the other a slight struma, but there was no symptom of disease of any of the glands with internal secretion. Uhthoff does not believe that these slight disturbances were connected ætiologically with the keratoconus.

ERGELLET (58, **Keratoconus**) had a patient 16 years old who had suffered from keratoconus for three years. The vision of the right eye was fingers at 1½ meters, of the left at 1 meter. Correction with a contact glass gave a vision of $\frac{6}{7}$ to the right eye, $\frac{6}{7}$–$\frac{6}{10}$ to the left. The advantages of the contact glass are described and the writer thinks that it is theoretically ideal. The only disadvantage is that not every eye can endure the contact for any length of time. So this patient developed a lesion of the epithelium of her cornea after she had worn the glass for forty-eight hours. After that she was able to wear the glass a few hours two or three times a week without trouble.

AXENFELD (57, **Dystrophia calcarea**) describes a case of a new form of this trouble, which was bilateral, began in youth, and developed gradually and indolently a peculiar circle about the center of the cornea. Otherwise the patient was perfectly well. The opacity was seated beneath Bowman's membrane in the parenchyma of the cornea, where particles of lime gradually settled, with a slow atrophy of the tissue. Treatment was ineffective. K.

AUGSTEIN (56, **Chemotherapy of ulcus serpens**) speaks energetically in favor of the optochin treatment of the pneumococcus ulcer. It is of the utmost importance to differentiate immediately a diplobacillus from a pneumococcus ulcer, for the writer believes that the former can always be cured by energetic treatment with zinc, and the latter by treatment with optochin. He considers the best way to use optochin is to saturate a bit of sterile cotton with a two per cent. solution, apply it to the ulcer, and leave the eye closed for from five to ten minutes; then instillation of a one half per cent. solution twelve to fifteen times a day, perhaps a couple of times at night. On the following days a reapplication of a two per cent. solution on cotton, according to the severity of the case. He says the results are "staggering." The final result is a more delicate cicatrix than can be obtained by other methods of treatment. He believes that every eye with an ulcus serpens can be saved by this specific treatment if seen in time.

VON WEHDE (62, **Optochin treatment of ulcus serpens**) gives the results of this treatment in the clinic at Rostock. Total number of cases in three years, 38. Optochin used in one per cent. solution, instilled six or eight times a day, with lukewarm applications and scopolamine. In thirty-one the ulcer was brought to a standstill, in seven it was not. He concludes that the results are very good when the ulcer is not too far advanced.

After abscission of the prolapse of iris from a wound of the eye, OESTERREICHER (60, **Implantation cyst after conjunctival keratoplastic**) covered the corneal wound with a conjunctival flap. Six months later he found a tumorlike mass, measuring 10*mm* by 6*mm*, attached to the cornea and protruding between the lids when the eye was open. It was not movable, was transparent, and was covered by thin bulbar conjunctiva. On extirpation it was found not to be in communication with the anterior chamber. Such an implantation cyst after this operation has not been observed before, to his knowledge, although they are not so very rare after operations for strabismus and pterygium.

FUCHS (59, **Secondary scleritis and episcleritis**) found in cases of chronic iritis and iridocyclitis, spontaneous, traumatic,

and sympathetic, an infiltration of the tissue of the sclera with lymphocytes and frequently with plasma cells, while polynucleated leucocytes were very scarce. The infiltration may be general or focal, sometimes is in the form of well circumscribed nodes, especially along the vessels. Schlemm's canal and the anterior ciliary vessels are always infiltrated the occlusion of the sinus of the anterior chamber by the root of the iris makes no difference in this respect. Along the posterior openings infiltration was found only in the minority of cases, mainly along the vortex veins, then along the ciliary arteries and nerves. Outside of the sclera, infiltration is always present from the limbus to the insertions of the recti, and is much greater at the limbus than along the anterior openings for vessels. In the posterior zone the infiltration is always far less dense than in the anterior, is never general, but always focal. It is localized in the episcleral tissue and Tenon's capsule; about the blood-vessels frequently as a prolongation of the infiltration about them in the sclera, and little foci of lymphocytes are frequent about the vessels which lie in close relation to the entrance of the optic nerve; about the blood-vessels which lie in the superficial layers of the sclera itself; and at the insertions of the ocular muscles. The infiltration in the posterior segment is always less than that in the anterior. In the latter, the aqueous has immediate access to Schlemm's canal, while the posterior passages drain only the perichoroidal space, which commonly is not much affected by the inflammation. The inflammation extends to the posterior segment of the surface of the globe in chronic cases either through the posterior openings, or, when these are normal, from the anterior segment, from which the irritating tissue fluid passes backwards in Tenon's space. The latter form of extension is the common one in purulent endophthalmitis, in which the surface of the posterior segment shows no sign of inflammation in the greater number of cases. In cases of panophthalmitis which perforate the sclera, a special infiltration takes place at the point where rupture takes place later; in fulminating cases this infiltration is spread over most of the sclera. Thickly packed polynucleated leucocytes lie in the outer layers of the sclera, while in the inner layers the nuclei of the scleral fibres are partially destroyed. Here

another means of transference of the inflammation from within outwards is to be found, by diffusion of toxic substances directly through the sclera with an attraction of polynucleated leucocytes. The process is the same as that which takes place in ring abscess of the cornea. The protrusion of the eye at the beginning of a panophthalmitis is caused by the saturation of the superficial layers of the sclera and the episcleral tissue with fluid containing fibrin, to which are added infiltration with lymphocytes and later proliferation of connective tissue and a new formation of vessels, which render the sclera adherent to the neighboring tissues.

K.

XV.—IRIS, PUPILS

63. FUCHS. **Shriveling of the iris.** *Klin. Monatsbl. f. Augenheilkunde*, lvi., p. 145.

64. METZNER and WOELFLIN. **Clinical and experimental studies of paresis of the cervical sympathetic.** *Archiv f. Ophthalmologie*, xci., p. 167.

Although shriveling of the iris, usually with ectropion of the uvea, is not rare in connection with increase of tension, FUCHS (63, **Shriveling of the iris**) has observed it with diminished tension. Three of his reported cases were traumatic, one of them being of crushing of the eye from behind. One case was of detachment of the retina in a soft eye, in another an exudate had formed in the vitreous from some unknown cause. The iris was so shrunken that it was scarcely visible at the margin of the cornea. In the cases in which the process could be observed, this great diminution of the iris took place in from eight to fourteen days. One anatomical examination was possible, which showed that the shortening of the iris was caused by a membrane that filled the sinus of the anterior chamber and spread from there over the anterior surface of the iris. The margin of the pupil was drawn over upon the anterior surface of the iris so as to cause an ectropion uveæ. The tissue of the iris was drawn together but not atrophic. The exudation was confined to the posterior parts of the ciliary processes and the anterior surface of the iris. Because of its thin endothelial covering the anterior surface of the iris is more sensitive to irritating substances than the posterior. The posterior layer of the retinal pigment epithelium was

shoved over the anterior. It is evident that to produce this sort of shriveling of the iris it is necessary to have a moderate degree of inflammation of the anterior surface of the iris and an absence of posterior synechiæ, as when it is fixed in this manner such a shrinkage does not occur. The formation of synechiæ was prevented by a lifting up of the iris from the lens, by the sinking back of the latter induced by a loss of vitreous, or by a detachment of the retina, and by the tension of shrinking masses in the vitreous space.

In order to obtain a closer insight into the various symptoms of paresis of the sympathetic, METZNER and WOELFFLIN (64, **Paresis of the cervical sympathetic**) instituted a series of experiments on rabbits. First the superior cervical ganglion was removed in order to study the question of the depigmentation of the iris. Nothing of this sort could be demonstrated, even by diascleral illumination, although the time allowed for observation was sufficiently long. The depigmentation described by other writers appears to have been due to a trophic disturbance. No essential changes in the fullness of the retinal and conjunctival vessels could be found. Sometimes there was a slight degree of exophthalmos. Differences in the retraction of the nictitating membrane were less marked. On the other hand, a contraction of the pupil of the eye on the side operated on appeared immediately and persisted with one exception. Then the sympathetic below the superior cervical ganglion was resected. No depigmentation appeared in the iris, but the pupil became still more contracted than after removal of the ganglion itself, so this part of the sympathetic must furnish an independent tone. Transient symptoms of paresis can be excited by stretching of the sympathetic, the duration of which varies with the degree of stretching, but may be permanent. A permanent myosis appears after removal of the middle ear, though the vasomotor disturbances retrogress. Similar pupillary trouble may occur in men after inflammation of the middle ear, though only a few cases have been reported.

XVI.—SYMPATHETIC OPHTHALMIA

65. SCHIECK. **Prevention of sympathetic ophthalmia in wounds of the eye received in battle.** *Ophthalm. Gesellschaft in Heidelberg*, July 31 and August 1, 1916.

SCHIECK (65, **Prevention of sympathetic ophthalmia**) controverts the idea that we do not become acquainted with sympathetic ophthalmia in the course of this war. Wounds of the eye received in battle form no exception to the rule, and need just as careful attention as wounds received during times of peace. It is only the fact that preventive enucleation is the method which has been adopted by surgeons that has prevented the occurrence of many cases of sympathetic ophthalmia. He reports eight cases that have followed shot wounds. In one of these it followed an opticociliary resection. In three the wounded eye was not removed until after the outbreak of the sympathetic trouble. In the remaining four the wounded eye was enucleated at a time when the other eye was perfectly intact; the enucleations proved not to be absolutely protective, although the cases ran mild courses. A certain percentage of such mishaps has always been observed, and it is to be expected that this percentage would show itself among the extraordinarily large number of preventive enucleations which have been, and still must be, performed in this war.

K.

XVII.—LENS.

66. BACHSTEZ. **Encapsulation of several foreign bodies in the lens.** *Klinische Monatsblaetter f. Augenheilkunde*, lvi., p. 492.

67. FLEISCHER. **Myotonia atrophicans and cataract.** *Ophthalm. Gesellsch. in Heidelberg*, July 31 and August 1, 1916.

68. FUCHS. **Lymphangioma at the place of a cystoid cicatrix.** *Klinische Monatsblaetter f. Augenheilkunde*, lvi., p. 145.

69. SCHEUBE. **The nonoperative treatment of senile cataract.** *Inaug. Diss.*, Jena.

FUCHS (68, **Lymphangioma at the place of a cystoid cicatrix**) found a dilatation of the lymphatics in the swollen conjunctival tissue in an eye which had been enucleated on account of a mild endophthalmitis ten days after an extraction of cataract. These lymphatics passed through the scar left by the operation and spread through the young connective tissue lying on the posterior surface of Descemet's membrane and the stump of iris, and also penetrated into the most posterior layers of the iris. A number of these vessels went directly through the sclera to the ciliary body, which they permeated. The scleral fibers were not simply pushed aside, but were directly worn

away. The vessels were lined with continuous endothelium. This new growth is to be looked upon anatomically as a lymphangioma.

SCHEUBE (69, **Nonoperative treatment of senile cataract**) believes that medicamental treatment of senile cataract must be considered ineffective because the best results which have been claimed for it are a partial clearing up of opacities and an improvement of the vision.

BACHSTEZ (66, **Several foreign bodies in the lens**) saw several little foreign bodies in a lens, which had been there for seven years and had caused no irritation aside from quite circumscribed opacities. There were similar opacities in the cornea, and an aperture in a corresponding place in the iris. He thinks it probable that the foreign bodies were of iron.

Myotonia atrophicans is easily to be recognized through the characteristic facies myopathica, caused by an atrophy of the muscles of the face, especially of the orbicularis oculi, with the production of a slight lagophthalmos, and of the orbicularis oris, through a difficulty of speech induced by atrophy of the musculature of the larynx, lips, cheeks, and tongue, and through atrophies in certain other regions, such as of the sternomastoid, or of the small muscles of the hand. Serious disturbances of the general nutrition, atrophy of the genital organs, vasomotor symptoms, and psychic troubles, together with the presenile cataract, which is not uncommon, mark the disease as due to a severe disturbance of an internal secretion. Among the cases of cataract at Tuebingen since 1900, FLEISCHER (67, **Myotonia atrophicans and cataract**) has found fifteen cases, eleven of which were subjected to a neurological examination. It is probable that the actual number present in this material was greater, but this is not certain. The ophthalmologist frequently has the first opportunity to recognize this rarely diagnosed disease, as it is the cataract which first leads the patient to consult a physician in a percentage of the cases which is not small. K.

XVIII.—GLAUCOMA.

70. GERTZ. **A case of detachment of the retina after** Elliott's **trephining.** *Ophthalm. Gesellschaft v. Copenhagen*, March 16, 1916.

71. GUNNUFSEN. **Tonometry of buphthalmos in a sleeping patient.** *Klinische Monatsblaetter f. Augenheilkunde*, lvi., p. 428.

72. ISCHREYT. **A case of primary sarcoma of the orbit with anterior adhesive iridocyclitis (Knies) in the luxated eyeball.** *Klin. Monatsbl. f. Augenheilkunde*, lvi., p. 492.

73. KOEPPE. **The rôle of the iris pigment in glaucoma.** *Heidelberger ophthalmische Gesellschaft*, July 31 and August 1, 1916.

74. SEEFELDER. **Concerning the relations of the so-called megalocornea and megalophthalmos to congenital hydrophthalmos.** *Klinische Monatsblaetter f. Augenheilkunde*, lvi., p. 227.

GERTZ (70, **Detachment of the retina after trephining of the sclera**) reports the case of a girl 20 years old, who had formerly been operated on for lamellar cataract, on whom Elliott's operation with iridectomy was performed for glaucoma. Some vitreous escaped from the wound. On the next day there was a great increase of tension with hemorrhage into the anterior chamber. The increased tension was reduced by eserine. About sixteen days after the operation the eyeball was soft and a nasal defect appeared in the field of vision, and later the entire retina became detached.

KOEPPE (73, **The rôle of the iris pigment in glaucoma**) demonstrated a more or less marked destruction of the pigment epithelium of the iris in more than forty cases of acute or chronic primary inflammatory glaucoma. This showed itself through a wandering out of dark brown and free pigment material, partly as very minute, partly as larger particles from the cells into the stroma, so that here and there, especially near the veins and the anterior limiting layer, it appeared to be permeated by them. Typical for this "pigment displacement" is its perfect irregularity with respect to extent, site, and distribution. Pigment dust is also to be found on the surface of the iris, on the corneal endothelium, and within the marginal portions of the cornea, as well as on the anterior and posterior capsules of the lens. In acute glaucoma more or less pigment dust is visible in the anterior chamber. Microscopically with lithium carmine stain and with the oil immersion, a very fine, dark brown free pigment material is to be seen, partly as little balls, partly as true dust, free in the stroma of the iris and in part of the ciliary body, especially in the lymph spaces and adventitial lymph sheaths of the vessels or

veins, particularly toward the anterior limiting layer. In more advanced cases of glaucoma may be seen separate light brown scales of pigment, likewise sometimes the result of the secondary destruction of the stroma pigment free in the stroma of the iris. All of these things can be observed more or less in healthy eyes, usually in both. The suspicion of the specificity of the pigment displacement for glaucoma is now confirmed by five cases, in which after an early diagnosis of glaucoma, or, as the author calls it, of preglaucoma, when there were no recognizable symptoms of the disease, glaucoma appeared and could be diagnosed from clinical manifestations. Because of this Koeppe believes it may be assumed that the pigment displacement has an ætiological significance perhaps for glaucoma simplex, and propounds the following theory: In consequence of a trophic disturbance, or a congenital weakness, a slow but irresistible morphological and biological cell destruction begins in the hitherto intact pigment epithelium, as well as in its derivatives, in the iris, and, in part, in the ciliary body. Just as powdered iron in Erdmann's experiment occludes the anterior outflow passages, so the free pigment globules, and dust which has undergone a certain chemical change and therefore become toxic, may possibly occlude the lymph passages and spaces, particularly the perivascular ones of the iris, chiefly at their openings. In addition this may lead perhaps to a contraction and gradual obliteration of the lumen and walls with the result that the stroma of the iris is affected by a slowly advancing atrophy. In this way a condition may be produced which is nearly related to, if not identical with, the glaucomatous predisposition. Thus is brought about a gradual decompensation of the circulation of the lymph, lymphatic engorgement, and the picture of lymphostatic glaucoma. Through involvement of the walls of the smallest capillaries and veins this may develop into hæmostatic glaucoma. If the blood pressure is increased suddenly through the sympathetic, the result is an acute attack of glaucoma. In the opinion of the author the absorptive action of the iris must be considered together with the sinus of the anterior chamber as of the first importance to the outflow from the anterior portion of the globe, as already claimed by Hamburger, the more so as they are often found com-

pletely occluded in glaucoma when the compensation of the sinus of the anterior chamber still exists.

K.

ISCHREYT (72, **Primary sarcoma of the orbit with anterior adhesive iridocyclitis**) had the opportunity to see a peculiar case of orbital sarcoma, which first came under observation as the result of a slight wound. There was much exophthalmos and the symptoms were steadily increasing. Incision into the orbit evacuated no pus. A transient pulsation appeared in the exophthalmic eyeball. Exenteration of the orbit revealed a necrotic sarcoma with a large cyst. A very interesting condition found in the enucleated eye, in addition to degeneration of various layers of the retina, was a close attachment of the root of the iris to the cornea and sclera at the sinus of the anterior chamber, so close that in places the line of demarcation could not be recognized. There was no special intermediate tissue. Some endothelial threads extended across the newly formed sinus. In spite of this fact the tension was not increased, but diminished. In an attempt to explain why glaucoma did not appear, it is suggested that the serious disturbances of the blood supply and nutrition prevented an increase of tension. Among 24,000 cases Ischreyt has seen nineteen with tumors of the orbit, of which eight were primary and eleven were extensions from tumors in neighboring parts.

GUNNUFSEN (71, **Tonometry of buphthalmos in a sleeping patient**) found that the tension during sleep was always materially lowered, the more so the higher the original tension. Three factors come into play for this reduction of tension: the reduction of the blood pressure; the myosis during sleep, which is particularly marked in children; and the decrease of secretion during sleep.

Opinions are divided as to whether megalocornea or megalophthalmos is to be looked upon as a giant growth, or as one of the symptoms of hydrophthalmos. SEEFELDER (74, **Megalocornea and megalophthalmos**) inclined formerly to the latter view, but has concluded from a case that came under his observation that the enlargement of both eyes may be due

not to a process of stretching, but to an abnormal degree of growth. The patient in question was sent to him for examination on account of large eyes when the former came to enter the military service. The diameter of the cornea was 14.5*mm*, the radius 7.2 vertically, 7.6 horizontally. The conditions which led Seefelder to exclude hydrophthalmos were: The absence of any corneal opacities, of any fissures in Descemet's membrane, and of any broadening of the limbus, the sharpness of the corneoscleral margin, the normal appearance of the sclera, even in the region of the anterior chamber, which was 8*mm* deep, the posterior part of which was bounded by the sclera, the absence of a glaucomatous cup, and of any disturbance of function, the regular astigmatism, the absence of increased tension, and the correspondence of the measurements in the two eyes. He suggests the name gigantophthalmos for such cases as this.

XIX. RETINA AND OPTIC NERVE.

75. AXENFELD. **Intraocular irradiation therapy.** *Ophthalm. Gesellschaft in Heidelberg*, July 31 and Aug. 1, 1916.

76. HIPPEL, E. V. **Signification of choked disk in shot wounds of the brain.** *Ibid.*

77. HIRSCHBERG. **Central recurrent retinitis in syphilitics.** *Zentralbl. f. prakt. Augenheilkunde*, March-April, 1916.

78. IGERSHEIMER. **A new way to recognize morbid processes in the optic tract.** *Ophthalmische Gesellschaft in Heidelberg*, July 31 and August 1, 1916.

79. LODBERG. **A case of chorioretinitis juxtapapillaris (Edw. Jensen) with stellate figure in the macula.** *Klin. Monatsblaetter f Augenheilkunde*, February-March, 1916.

80. MUELLER. **Intracranial increase of pressure with choked disk** *Muenchener medizinische Wochenschrift*, No. 20.

81. ROENNE. **A case of acute retrobulbar neuritis with wandering defect in the visual field.** *Klin. Monatsbl. f. Augenheilk.*, February-March.

HIRSCHBERG (77, **Central recurrent retinitis in syphilitics**) reports a case of retinitis which he has followed for twenty-seven years. It recurred frequently and responded well to antisyphilitic treatment. After one attack a parafoveal focus remained, in the neighborhood of which during recurrent attacks fresh, bluish infiltrations appeared in the retina, which suggested a partial blocking of the blood by the old focus. The final result was a scotoma with full central vision.

LODBERG'S (79, **Chorioretinitis juxtapapillaris**) case was characterized by a stellate figure in the macula although no nephritis was present. The stellate figure underwent involution and the vision rose from $\frac{1}{18}$ to $\frac{5}{6}$.

AXENFELD (75, **Intraocular irradiation therapy**) stated that the case reported by him and others in 1915 of bilateral glioma retinæ had been kept under observation and that the retrogression of the three gliomata induced by irradiation with hard gamma rays had continued until the largest tumor had completely disappeared, leaving only an evidently dead preretinal trace. An expected cataract developed in this eye late in the fall of 1915, and was extracted in the summer of 1916. The restoration of vision to the child, now three years old, was delayed, as the six months' blindness during the formation of the cataract had induced a condition like that of amaurosis after blepharospasm, which passed away after about three weeks. No recurrence of the growth had taken place meanwhile. How far the function of the retina is impaired must be determined later. Otherwise the child is well developed physically and intellectually. The heavy doses of rays administered are plainly not to be borne by the growing lens, but this is not a contraindication to irradiation therapy for glioma. It is only in the second eye, and only when the vision has not been too greatly impaired, that irradiation treatment should take the place of enucleation in glioma.

K.

MUELLER (80, **Increase of intracranial pressure with choked disk**) recommends as an operative measure for choked disk due to cerebral affections the trephining of the sheath of the optic nerve. After Kroenlein's operation a piece of the sheath measuring four by eight millimeters is removed. Choked disk undergoes involution not only upon the same side, but in many cases on the other also.

VON HIPPEL (76, **Choked disk in shot wounds of the brain**) emphasizes the need of a differential diagnosis between choked disk and papillitis in every case, though this is not always attainable. Choked disk is very frequent soon after shot

wounds of the skull. Often it quickly undergoes involution, either spontaneously or under the influence of proper surgical treatment of the wound. Conditions that favor increased intracranial pressure are present after shot wounds of the skull, whether the dura has been wounded or not. Most of the swellings of the papilla seen early after such wounds, which have been called by various names in literature, are true choked disks. The swellings of the papilla that appear late are mostly due to abscess of the brain, meningitis, or a cyst, and may be either choked disk or papillitis. The prognosis of choked disk after wounds of the skull is good in so far as that if the patient lives the swelling of the papilla is likely to go down, but whether the choked disk is or is not a bad sign cannot be stated with certainty. Choked disk alone in the early stage calls for no special treatment, least of all for an operation, but as in most cases it is only one symptom out of many, and not infrequently the general condition necessitates an operation, opportunity is often afforded in gunshot wounds of the brain to see the prompt retrogression of a choked disk after an operation that reduces the pressure. A swelling of the papilla appearing in the late stage shows with certainty that a cure was only apparent and forms an imperative indication for surgical intervention.

K.

IGERSHEIMER (78, **A new way to recognize morbid processes in the optic tract**) ascertained that every interruption of conductivity, or serious disturbance of a bundle of fibers in the optic nerve manifests itself externally as a scotoma extending outwards from the blind spot. Hence it is possible to demonstrate with great exactness even very slight troubles of both the peripheral and the central bundles in the path of conduction. This is very often of considerable importance not only for the early diagnosis, but also for the prognosis and treatment. The essential feature of the method is perimetry vertical to the course of the nerve fibers in the retina. He uses a disk two meters in diameter with a radius of curvature of one meter. It has been demonstrated anatomically that most of the decussated and non-decussated fibers describe concentric arches from the blind spot to a point of fixation and then

bend off to the periphery. This furnishes an easy explanation of the occurrence of a ring scotoma in affections of the optic nerve. The isolation of the papillomacular bundle pathologically is made doubtful, as Igersheimer almost always could demonstrate, in addition to the defect of the central fibers, one of the peripheral in cases of alcohol-tobacco amblyopia, and retrobulbar neuritis caused by affections of the accessory sinuses. It was shown how the new method is able to reveal early affections of the optic nerve in glaucoma, troubles of the anterior segment of the globe, such as iritis, contusions, and perforating wounds, as well as in affections of the orbit, and in multiple sclerosis, tabes, and nephritis. Depending on the same principle disturbances at the chiasm and in the central optic tract are demonstrable at a much earlier period than heretofore.

K.

ROENNE'S (81, **Retrobulbar neuritis with wandering defect in the visual field**) case began with loss of the nasal lower quadrant, which was replaced by a relative paracentral scotoma to the nasal side of the center. This defect gradually moved into the upper nasal quadrant of the visual field, where it grew less marked and finally ended with a distinct, though not strongly accentuated, hemianopic boundary line in the upper nasal quadrant, before it passed over to complete recovery.

XX.—ACCIDENTS, WOUNDS, FOREIGN BODIES, PARASITES.

82. HERTEL: **Wounds of the eye by foreign bodies in war.** *Ophthalmische Gesellschaft in Heidelberg*, July 31 and August 1, 1916.

83. LOWENSTEIN. **Wounds of the eye in war in the mountains.** *Ibid.*

84. OLOFF. **Psychogenous injuries of the eyes in war.** *Ibid.*

85. PINCUS. **Clinical observations of shot wounds of the occiput.** *Ibid.*

86. UHTHOFF. **Injuries of the central visual tracts and centers in wounds of the skull.** *Ibid.*

Wounds of the eye form two per cent. of the entire number of wounds in battles on plains and wooded hills, according to LOWENSTEIN (83, **Wounds of the eye in mountain war**), as observed by him in Serbia and Carpathia. But in the Alps he has found them, after twelve months' service, to amount to eight per cent. The great majority of these wounds are

caused by bits of stone, seventy-two out of ninety-eight perforating wounds, thirty-five being of both eyes. Next to the bits of stone come splinters of metal, about equally divided between the magnetic and the non-magnetic. In most cases the foreground of the clinical picture is occupied not by the wound of the eye, but by the simultaneous lesion of the skull. The bits of stone driven into the face caused suppuration for the most part and precluded the possibility of an aseptic operation on the eye. Very often it was hard to differentiate between a contusion and a perforating wound when the anterior chamber was filled with blood and the wound of perforation was minute. Contusion of the cornea gave the writer a clinical picture hitherto unknown to him, which was much more common—observed fourteen times—than Vossius's ring opacity of the lens, of which only three were seen. Commotio retinæ and ruptures of the choroid were frequently to be seen after contusions with stones. Bits of stone become encapsulated in all the tissues of the eye, for the most part without reaction. Five cases of bits of stone in the iris, which could not be extracted immediately on account of the suppuration in the face, remained without reaction for eight weeks. Of twenty-one wounds of the lens by bits of stone, seventeen showed an opacity of the posterior cortex immediately after the lesion, which ended in all seventeen in total opacification. In four the opacity, which was of no less extent, was localized in the anterior cortex, and none of these showed any progression whatever. Only seventeen blind eyes had to be removed out of a total of 133 perforating wounds. As he had not met with sympathetic ophthalmia in his cases he employed conservative treatment so far as possible for wounds of the eye incurred in mountain war.

K.

HERTEL (82, **Wounds of the eye**) found bits of steel in sixty per cent. of 242 cases of intraocular foreign bodies, the remainder consisting of copper, brass, powder, stone, straw, wood, and glass. The wounds presented almost uniformly such a picture as is produced by blasting, or explosions, multiple lesions in the face, both eyes struck in twenty-one per cent., and not rarely several splinters in one eye. The force of impact usually was

very great, as shown by the great hemorrhages within the eye, the penetration of particles as minute as $\frac{2}{10}$ *mg* into the posterior segment of the eye, the frequent occurrence of wounds of entrance through the closed lids often with tearing of pieces of bone from the wall of the orbit, and the frequency of double perforation. Examinations with the X-rays and sideroscope were indispensable to diagnosis. When the bits of metal weigh less than 3 *mg* the X-rays may fail, but Hertel's sideroscope points them out if they weigh as little as $\frac{2}{10}$ *mg*, provided that they contain iron. Both methods fail when many splinters have entered simultaneously, and in cases of double perforation. Magnet extractions of fragments of steel are considerably less successful in war than in peace; the writer states that in peace he had eight per cent. of failures, while in war they have amounted to thirty per cent., and thinks this is due to the facts that on the average the wounded eyes are operated on later in war, that the force of impact was greater, and that double perforations were more frequent. Steel splinters from bombs are more irregular and jagged, and had more admixtures, especially with phosphorus, nitrogen, and manganese, which made their ability to follow the magnet less than that of splinters from steel tools, such as are met with in times of peace. Repeated observations seem to show that the admixtures favor a rapid onset of siderosis. Bits of copper and brass are successfully removed in a certain number of cases, yet half of the eyes subsequently are lost from infection, detachment, and other particles which have not been removed. Bits of stone were removed from the anterior chamber, but in only two were the eyes saved after removal from deeper portions. No attempt was made to remove the foreign bodies in other cases in which the eyes had been wounded by bits of stone, because they could not be located accurately. Powder driven into the eye was well borne in part of the cases. Bits of glass were almost always infected. Bits of straw and wood could be removed only from the anterior chamber.

K.

PINCUS (85, **Shot wounds of the occiput**) has studied twenty-two, mostly old, cases of visual disturbance after shot wounds

of the occiput. He found an optic neuritis in only three. The intensity and extent of the functional trouble are often disproportionate to the demonstrable traces of the external injury. The typical picture of homonymous hemianopsia was furnished by eight cases, but almost never so clearly as is commonly the case in diseases of the occiput. One case of wound of the left occipital lobe had optic aphasia and right-sided hemianopsia, which did fairly well after the shot had been removed. In five cases a hemianopsia inferior was present in varying degrees, only once in consequence of a typical cross shot. In one patient, who presented peculiar symptoms of fatigue, relatively darkened portions of the visual field became absolutely dark during an epileptoid fit. Once a hemianopsia superior could be demonstrated in the form of symmetrical scotomata in the left upper quadrant; in this case the X-rays showed a piece of a bomb in the optical radiation, but not in the cortex. When the visual centers in both sides of the brain were wounded, symptoms of disturbance of the higher visual faculties came more into the foreground; in two cases macular vision was preserved, while in two others it was lost although the greater part of one half of a visual field was saved. Symptoms of fatigue the author thinks are not always to be considered hystero-neurasthenic complications, but in many cases to be the expression of organic injury of the visual centers. Not only the perception, but also the correct projection of strong lights, is found to be preserved in the blind portions of the field. On the other hand, he knows of cases in which the defects of the visual field were of not so high a degree, but suffered from extraordinarily severe disturbances of the higher visual faculties.

K.

UHTHOFF (86, **Injuries of the central visual tracts and centers by shot wounds of the skull**) has observed forty cases of shot wounds of the occiput, three-fourths of which were complicated by hemianopic visual troubles. The cases were grouped into those having bilateral, monolateral, and no hemianopsia. The number of those with bilateral hemianopsia was greater than that of those with monolateral. Permanent total blindness was not observed after these occipital

wounds, except in one case in which a complicating meningitis induced a neuritic atrophy of the optic nerve and blindness. In only one case was the impairment of vision great enough to cause the patient to be classed with the economically blind. Four of the patients died. Hemianopsia inferior was much more common than hemianopsia superior, of which there was only one case. Only quite isolated examples of disturbances of the visual field which were not hemianopic in character were met with in this series of wounds of the occiput. Primary transient blindness, or great visual troubles which later improved, were very common, likewise primary loss of consciousness. The ophthalmoscopic condition was usually normal. Neuritic signs at the entrance of the optic nerve indicated a brain abscess in many cases, but in others this complication was absent. On the whole, little was seen of pupillary and muscular disturbances. Hemianopic hallucinations were observed in a few cases. With the exception of one, all of the patients were rendered unfit for further service in the field.

K.

After a brief explanation of the term psychogenous injuries as a collective name for hysteria, neurasthenia, and traumatic neurosis, and remarks concerning the existence of a sharply defined clinical picture known as traumatic neurosis caused by organic cerebral changes, OLOFF (84, **Psychogenous injuries of the eyes in war**) discusses the causes which induce these conditions in the present war. The principal part is played by the drum fire, explosion of bombs, and other severe explosions, that have not inflicted any physical trauma. In rare cases a psychogenous injury is grafted upon a wound, which cannot be explained through corresponding organic changes. The clinical picture is characterized, as a rule, by great diversity of symptoms, yet is not to be differentiated in its essential forms from the diseases met with in times of peace. In the foreground stand complicated motor signs of irritation and deficiency. Sudden deafness, complicated with dumbness, is not rare. Markedly few, on the contrary, are the psychogenous injuries of the eyes caused by battle thus far observed. The cases which have been described were all local phenomena

of a general hysteria with the usual hysterical symptoms outside of the eyes. Oloff reports two cases, in both of which the cause was great psychical high tension, due in one to the explosion of a bomb in the trench. In both of these cases the typical hysterical symptoms were confined to the eyes, and showed themselves pre-eminently in the form of spasms of the ocular muscles. Other hysterical symptoms outside of the eyes were completely wanting. It is also worthy of note that both of the patients were large, strong men, who had never before suffered from any nerve trouble. A hereditary taint could be determined in only one. These cases confirm the neurological observation already made in this war, that here and there healthy persons who have no hereditary taint may become hysterical in consequence of great mental exhaustion and shock, due wholly to the weight of the catastrophic occurrences of the war, and that hysteria may run a monosymptomatic course. OLOFF reports several other cases in which the psychogenous injuries of the eyes were local phenomena of a general hysteria and presented nothing special in their courses. The prognosis of psychogenous battle injuries of the eyes corresponds in general to that of war hysteria, and must be considered less favorable as regards the final result. He therefore recommends that such patients should not be sent again to the front, but to discharge them as unfit for service, as they are perfectly competent to perform their civilian duties. Some could be utilized for garrison duty.

K.